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CONTENTS.

EDITORIALS 109
Recent Progress in Dirigible Balloons 112
Extending New York's Subways 112
Chicago Section of the Electrochemical Society 113
East River Tunnels Open September 8 113
Jasper M. Keller 113
Commonwealth Edison Outing 115
Commission News from New York 114
The Empire State Gas and Electrical Association 114
Traction Litigation Settled 114
The Boulogne Wireless Station 115
Receivers for Telephone Company 117
Raise Recommended for Telegraphers 117
Wireless on German Vessels 117
CANADIAN ELECTRICAL ASSOCIATION 118
Contracts for Lighting and Power Service 119
The Commercial Agent and the Community 119
The R. C. M. Electrical Service Rate System 119
Residential Lighting Field: How It Can be Profitably Cultivated 120
Accounting System Report 121
Transmission Line Regulation 121
How to Increase the Station Load 122
Report of Committee on Meters 122
Tungsten Lamp as Factor in Modern Lighting 122
Attitude of Central-Station Managers Towards Illuminating Engineering 122
Convention Notes 123
Railroad Commission of Wisconsin News 123
Electric Equipments for Pullman Cars 123
A Comparison of Magnetic Permeameters 122
Binders for Coal Briquets 126
Power Plant for Oregon Mining Camp 128
Rejects Municipal Ownership of Lighting Plant 128
Cohoes to Use Electric Power 128
Water-tube Boilers for Power Station 128
Weather Reports by Telephone 128
The Measurement of Surface Brightness 129
Cheaper to Wire During Building 131
Use of Flaming Arcs for a Large Arena 132
Cincinnati Inadequately Lighted 132
Telephones in the Zion City Lace Factory 133
Telegraph Record Made at Reno 133
Ouster Suits Brought in Kansas 133
The History of the Telephone 134
New Telephone Building in Philadelphia 136
Telephone Companies Merge 136
New Distributing Cable 136
English Laboratory Opens 136
Electricity in the Contractor's Service 138
To Generate Electricity by Tunnel Drainage 138
Electricity in Mining 138
Electricity in Kansas Mines 140
Electric Power for Quarries 140
AMONG THE CONTRACTORS AND SUPPLY MEN 140
International Telegraph Tournament 140
American Society for Testing Materials 141
International Association of Municipal Electricians 141
NEW ELECTRICAL AND MECHANICAL APPARATUS AND APPLIANCES 142
CURRENT ELECTRICAL NEWS 147
RECORD OF ELECTRICAL PATENTS 153

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CENTRAL-STATION RATES.

Whether or not the central station has suffered from the widespread use of the tungsten lamp, far-sighted managers are anticipating the time, in the near future, when the efficiencies of the lamps in general use will be greatly increased—when high first cost and fragility will no longer tend to retard their universal adoption. Therefore, in view of this impending "crisis," expressions relating to a feasible adjustment of rates are worthy of serious consideration. Electric light associations throughout the country are including in their programmes for their annual gatherings, papers dealing with this vital subject and the earnestness of the subsequent discussions are indicative that the realization of a final adjustment is imminent.

In this connection, attention is called to a very able paper, proposing a system of rates, presented at the recent meeting of the Canadian Electrical Association by Mr. S. Bingham Hood, and abstracted in this issue.

Mr. Hood, working along the lines of the Doherty rate, has developed a differential rate system composed of a readiness-to-serve charge, a consumers' charge and a kilowatt-hour or meter charge. In the much-referred-to paper of Mr. S. E. Doane, presented at the convention of the National Electric Light Association, the author indicates the desirability of a higher readiness-to-serve and customers' charge and a lower kilowatt-hour charge. These conditions seem to have been met in Mr. Hood's rate.

The readiness-to-serve charge is obtained by dividing the sum of all annual fixed and operating charges, which vary with the size of the plant, by the total kilowatt capacity of the generating equipment. The customers' charge includes all those expenses which vary directly with the number of consumers connected to the system. The total of these expenses divided by the number of customers connected to the system will give the charge, which is made to every consumer irrespective of his demand or character of load. The kilowatt-hour charge covers all expenses which vary directly with the kilowatt-hour output of the system.

For residence lighting the demand of the consumer is arrived at by considering the floor space lighted. Only that portion of the room requiring light is considered.

It is certainly true that such a rate, if carried out, would minimize any possible detrimental effect on central-station profits from the introduction of tungsten lamps.

Whether or not it is feasible for any central station to put it into effect depends, in most cases, on how far the readiness-to-serve method of charging is recognized in the existing rates of that company. Many contend that it is better for the central stations to let some of the larger consumers pay for the losses on the small ones than to attempt to adjust rates exactly in an equitable manner.

However, the method of arriving at the customer's demand, as proposed by Mr. Hood, is worthy of serious thought. For residential lighting it is obviously not practical to consider the connected load as representing the actual demand, as such a load will never all be used at the same time. It is also not practical to base the demand upon any fixed percentage of that demand as it has a strong tendency to keep the load at a minimum, whereas the maximum should be encouraged. For similar reasons a system based on the number of rooms is unjust to the consumer, as certain rooms will be used more than others.

And, aside from the technicalities of the subject, it would seem that a rate schedule as proposed by Mr. Hood would be more easily understood by the customer and would tend to simplify the calculation of bills.

VECTOR DIAGRAMS.

The great beauty, simplicity and utility of the vector diagram for representing alternating-current phenomena must be realized by every student of this subject, when he first meets it in an elementary text-book and masters the method. The disillusionment as to simplicity comes with a shock when he first attempts to assimilate a treatise in which a different method of vector representation is followed. After several similar experiences he begins to wonder whether vector diagrams are of any use anyhow.

After finally getting acquainted with the various methods of applying this valuable system to practical problems, he still finds it necessary, on approaching a new book or technical article, to expend his first installment of available mental energy in determining whether the author considers the vector or the line upon which it is projected to rotate, whether the rotation is positive or negative, or whether the vector represents the diameter of a circle in a polar diagram in which the only rotation is performed by an imaginary radius-vector.

This lack of uniformity in the diagrammatic representation of periodic phenomena is not only confusing to all but those who are very familiar with the different methods, but it consumes a great deal of energy which should be available for application to the problem itself. It carries all the disadvantages which are usually avoided by convention and standardization. Many would-be readers are discouraged from attempting such reading at all.

At the recent convention of the American Institute of Electrical Engineers, Prof. A. E. Kennelly emphasized the need of uniformity, and showed that the lack of it was world-wide. The Institute voted to bring the matter to the attention of the International Electrotechnical Commission. If this Commission can reach an agreement whereby a single method of representation shall have international sanction it will bring great relief to the reader of electrical literature in the future. If international agreement cannot be reached, our national societies should take some action. Of course no author would be bound to follow a set method, but if the official system was reasonable enough to secure the support of the technical press and the majority of teachers of electrical engineering, offending authors would soon find their books under the ban.

The question is one of convention, since one method cannot be called right and another wrong. The great consideration is to have uniformity, to use a single language, and this can only be secured through co-operation and agreement.

STREET CONGESTION AND GOOD ROADS.

Captain Charles C. Healey, of the Chicago mounted police, has recently returned from a tour of inspection of European cities, made for the purpose of acquiring information of methods to relieve street congestion in Chicago.

His report, of 8,500 words or so, emphasizes the necessity for several things, which may be briefly stated as follows: (1) Recognition of police authority at crossings, by pedestrians and drivers of vehicles. (2) Right of way for street cars,—fast traffic to keep to the center of the roadway, slow-moving vehicles to keep close to the curb. (3) Automobiles to replace horse-drawn vehicles. (4) Subways, not only those for through traffic but also for pedestrians at busy street crossings.

The first of these recommendations to which attention is drawn, reveals what is unfortunately a national affliction in this country, a general disregard for good laws and a laxity in enforcing them. This is largely a result of the peculiar conditions under which our country has risen, in a hundred years or so, from a comparatively insignificant colony to one of the greatest of nations. The settling-down process is now in course of evolution, and time, patience and tactful administration may be relied upon to effect a gradual but permanent cure.

The second recommendation is practically included in the first, for it is only asking for an enforcement of a traffic law already included in many urban and local by-laws.

The third recommendation is a sign of the times—the horse on our city streets must go—but incidentally it brings up another matter of great importance, the necessity for good roads and the means of keeping them in good repair.

It is a national disgrace that participants in the recently concluded Glidden tour continually referred in their reports to "roads which are the worst in the world." It is not that road building is not understood in the United States, for there are *some* roads here as good as any in the

world,—but how few of them! Even in our large cities there are miles and miles of roads that would be considered a disgrace in even the remotest country places in France, Sweden or England. In Chicago, for instance, one can travel miles along Milwaukee Avenue without finding a drain on either side of the roadway to carry off the surface water. Horses with heavy loads stagger along and tear up the mutilated road surface in their efforts to obtain a foothold; high-powered automobiles cut the road to pieces when the brakes are jammed down hard to prevent a collision. It is little wonder, then, that vehicles seek the trolley rails, and thus hold up the cars an aggregate of perhaps two or three hours daily.

There is a remedy. Abolish the horse and use the electric vehicle, which is the easiest of all the automobiles on the road surface. Instead of burdening the traction companies with heavy charges on their earnings, let them keep their roadways in repair, and see that they do it. Supervise the traction companies, if you will, but do not legislate them out of business. Encourage them to consolidate, for this means economy, and then when their earnings permit it, make them build subways where an adequate return on the investment would be assured. Municipal ownership theoretically may be a good thing, but a well-managed private company in this country seems to have shown itself superior. Above all, however, build good roads and keep them in repair, and make the land agents include "good roads" in their inducements to home builders, as well as "cement pavements, sewers, gas and electric lights."

IDENTIFICATION MARKS.

In central stations and in many other establishments, much inconvenience has been caused from time to time, in making repairs, charges and extensions, by a want of a ready means of identification of pipe lines, conduits, etc., which appear in such profusion when an excavation is being made. For steam, gas and water pipes, a color scheme has recently been proposed by which the pipes could be identified by the color of the paint or other preservative coating used. There are obvious drawbacks, however, to this scheme.

An alternative plan which seems to promise better results would be the standardization and adoption of a universal scheme of identification marks and symbols, similar to and possibly including those adopted for drawings by the National Electrical Contractors' Association of the United States and the American Institute of Architects. Stencils could be made of these marks and supplied at a small cost to all those interested, and conflict would be avoided by making the scheme as universal as possible. The matter is recommended to the attention of the great engineering societies and the national and state electrical associations.

TRANSFORMER REGULATION.

It has been customary to compute the regulation of a transformer from the measured values of resistance and of impedance volts on short-circuit. Since on short-circuit the lag of the current must be excessive, it is evident that the conditions in the transformer are not the same as in normal operation. This has long been recognized, but as no definite error due to the method had been established, and as the procedure was convenient, the method gained very wide application. Since the measured quantities were small, and the regulation determined directly from them, the errors which existed were due to the method rather than to any inaccuracies in the measurements, and this condition of affairs always tends to inspire unmerited confidence in the results.

In a paper presented at the Jefferson convention of the American Institute of Electrical Engineers, and abstracted in our last issue, Prof. Adolph Shane gave two methods for determining regulation which are free from the objections of the short-circuit test and are at the same time more accurate than the direct method of measuring voltage with and without load.

The fundamental idea of the new methods is to have a second transformer identical with the one under test, and by connecting their secondaries in opposition while the one is loaded the difference or impedance drop of voltage is obtained experimentally. But since a difference of phase is involved, the regulation drop is not represented by this impedance drop, but by the component of it which is in phase. Consequently in the first of the new methods, this component is balanced by the voltage from a third adjustable transformer, which can then be read.

In the second of the proposed methods, the difference in voltage is applied to the potential terminals of a wattmeter carrying the load current. The copper loss and hence the resistance drop are thus determined. From these data and the impedance drop, the regulation can be readily computed.

The requirement of a duplicate transformer and an additional adjustable transformer is easily met in the factory and it is here that the new methods should find their widest application. For the central-station man, the duplicate transformer will usually be available in the smaller sizes, but not always in the larger sizes, and the adjustable transformer and instruments of suitable range will frequently be lacking. For the well-equipped laboratory the new methods are not so necessary, since an accurate measurement of ratio with and without load can be easily made with proper facilities.

The principal value of Professor Shane's paper lies in demonstrating the unreliability of the short-circuit test, and offering a substitute which is quite practical for the testing-room.

Recent Progress in Dirigible Balloons.

At a special summer joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers that was held in the rooms of the latter society, Monadnock Block, Chicago, on the evening of July 8, W. A. Bloneck delivered an illustrated informal lecture on "Recent European Progress in Dirigible Balloons." Mr. Bloneck had just returned from several months personal study of the subject in Germany and France and had gathered a large number of photographs and lantern slides, besides a mass of technical and commercial data respecting these airships.

Dirigible balloons were first developed in Europe by the various military authorities and for some time little was made public regarding the progress achieved, as it was deemed a tactical advantage to keep everything secret. As experimentation became more general, however, uses other than military were found for the new craft. The greatest development along this line has been in Germany, where even the old-established electrical firm, Siemens-Schuckertwerke, has interested itself in various features of dirigible manufacture.

Three types of dirigible balloons have been built, the rigid type, exemplified by the Zeppelin airships, the semi-rigid type, such as the French craft *La Patrie*, and the non-rigid type developed on the Parseval system. Of these the Zeppelin airships have perhaps created the greatest attention; a number of them have been built at great expense in sizes up to 500 feet long and 40 feet in diameter, carrying thirty-two passengers. Routes have been laid out and a company formed to carry on regular passenger traffic. Between Mannheim and Dusseldorf in Germany, the stretch has repeatedly been covered in four hours, whereas regular express trains take six hours. A number of unfortunate accidents with the Zeppelin craft, however, have shown some of the disadvantages of the rigid type of dirigible. The semi-rigid type has been used largely in France; it has considerable complexity in its make-up. The non-rigid system developed by Parseval has a flexible cigar-shaped gas bag in which are inclosed two small ballonets, fore and aft; by inflating one or the other of these with air the craft is made to descend or rise. Mr. Bloneck described the various types in great detail.

For passenger transportation the results in Germany have been demonstrated that the traffic that can be easily secured will greatly exceed any facilities that can be provided. On the lines already established terminal depots have been erected to house and charge the dirigibles, lighthouses have been built with upwardly projecting searchlights to guide them by night, test stations constructed with boxkites for determining the direction and velocity of the upper air currents, and in other ways the business put on a commercial basis. Aside from the established passenger rates, which are rather high as yet, an additional source of revenue has been found from the advertising value of projecting firm names or products on the sides of the gas bag at night. For this service the charge of $25 per firm per night has been established for showing a name twenty times a night for fifteen seconds at each time.

From reliable data that Mr. Bloneck had secured he calculated the total cost of a dirigible of the Parseval type, 300 feet long by thirty feet in diameter as $80,000; it would have a maximum lifting power of 14,000 pounds and could easily carry sixteen passengers, one captain, one pilot and two engineers. Assuming it to be used only 150 favorable days a year, a conservative estimate of the total yearly income from passengers and advertising would be $367,500, whereas the total expense would be only $35,000.

In contrasting aeroplanes with dirigible balloons, Mr. Bloneck pointed out three very serious inherent drawbacks to the commercial possibilities of the former. (1) Whether it be a monoplane or biplane, the aeroplane is essentially a high-speed machine; therefore it cannot run slowly in order to avoid accidents in landing which are very frequent. (2) It has no automatic stability and therefore can easily turn turtle if slightly deranged. (3) Its weight and construction are such as to prevent the use of a multiplicity of engines; therefore when the single engine fails the machine is absolutely helpless at the mercy of the elements, whereas on a dirigible when one engine fails a reserve engine or engines can be conveniently started up. In conclusion Mr. Bloneck stated that in order to fly in an aeroplane one had to be an acrobat, which limited the machine practically to sporting purposes, while the dirigible balloon can be used for a number of commercial purposes as well.

Extending New York's Subway.

In a recent letter written by Theodore P. Shonts, president of the Interborough Rapid Transit Company, to the Mayor of New York City, a plan is outlined for the extension of subways in Manhattan, Brooklyn and the Bronx.

Mr. Shonts' proposition is for a line from Times Square through Seventh Avenue as extended and West Broadway to Liberty Street as a four-track road, and from Liberty Street to the Battery as a two-track road, with a branch from West Broadway and Liberty Street, under Liberty Street and East River to Pineapple Street in Brooklyn, and through Pineapple and Fulton Streets to a connection with the Brooklyn extension of the existing subway as a two-track road and a further extension from Atlantic Avenue through Flatbush Avenue and Eastern Parkway to Nostrand Avenue as a four-track road.

Also a route from about Thirty-fifth Street through Park Avenue and private property at or about Fortieth Street to Lexington Avenue, up Lexington Avenue across the Harlem River to a point south of One Hundred and Forty-ninth Street as a four-track road; thence with a two-track connection to the West Farms branch of the existing subway, and two tracks up Mott Avenue through One Hundred and Fifty-third Street and up River and Jerome Avenues to One Hundred and Ninety-fourth Street, with the privilege of making three tracks between One Hundred and Sixty-second and One Hundred and Ninety-fourth Streets; the extension through River and Jerome Avenues to be an elevated structure.

Mr. Shonts suggests that the lease be at least coterminous with the unexpired portion of the term of the subway built under contract No. 1, but that the city should have the right after ten years to take back the extensions upon reimbursement to the Interborough of the cost of equipment plus fifteen per cent.

Chicago Section of the Electrochemical Society.

An even dozen of the members of the American Electrochemical Society residing in the vicinity of Chicago met together in the rooms of the Western Society of Engineers on the evening of Thursday, July 7, and organized a local section of the Society. The local section will embrace all members residing or doing business within fifty miles of Chicago, and it is expected that the existence of such a section, holding local meetings every one or two months, will greatly stimulate interest in the subject of electrochemistry and bring together a great many men who are not at present affiliated with the national society.

Permission to organize the local section was granted by the Board of Directors of the Society during the annual meeting held in Pittsburg in May last. By-laws have been adopted and the following officers were elected: Chairman, Prof. H. N. McCoy, of the University of Chicago; secretary, Arba B. Marvin, 950 Commercial National Bank Building. The appointment of additional members of the executive committee was left with the chairman.

In addition to the officers above mentioned, there were present F. M. De Beers, D. J. Block, W. Brady, A. E. Greene, A. R. Johnson, Otto Kney, F. T. Snyder, M. G. Lloyd, H. K. Weld, E. R. Walcott.

It was decided to invite the American Electrochemical Society to hold its fall meeting in Chicago next October, and assurances were given that this invitation will be accepted.

East River Tunnels Open September.

It has been definitely announced by Ralph Peters, president of the Long Island Railroad, that the East River tunnels from Long Island City to the Pennsylvania Railroad station in New York City, will not be opened until September 8. While tracks and platforms will be ready by August 1, the opening will be delayed by the installation of furnishings and fixtures.

Jasper N. Keller.

Forty-eight years ago, Jasper N. Keller, who has just been elected president of the New England Telephone and Telegraph Company, Boston, Mass., became a telegraph operator. He began as night operator at Lima, Ohio, in the service of the Pittsburg, Fort Wayne & Chicago Railway Company, and was at the time one of the youngest in the service. Shortly after this, he went to the Far West, continuing as a telegraph operator at different points in Nevada, and in San Francisco. He was also for a time at Ogden, Utah, in the office of the Central Pacific Railroad, and with the Northwestern Railroad at Boone, Iowa.

JASPER N. KELLER,
President of the New England Telephone and Telegraph Company.

Mr. Keller early saw the benefits of the telephone, and was one of those who at an early day left the telegraph field to enter telephone work. He established one of the first telephone exchanges in the West, at Ogden, Utah, in 1879. It 1881 he went South, and built up the great Southwestern Bell system in Texas and Arkansas. He went with the New England Company in January, 1885, as general manager and has been active in its affairs ever since.

It is a very proper tribute to Mr. Keller's ability and experience that he should have been elected president of his company at a meeting held a few weeks ago. The New England Company is one of the most successful in the field, and the quality of service given to patrons is of the very best.

Mr. Keller is the possessor of a large farm in New Hampshire, and his days of recreation are devoted to tilling the soil, raising fruit, and looking after the many fine old trees surrounding his country home.

Commonwealth Edison Outing.

The fifth annual field day and outing of the Construction Department of Commonwealth Edison Company, at Glenwood Park, forty miles from Chicago, Ill., was given on Saturday, July 9, and was attended by a crowd estimated at over 700, which included a large number of ladies.

Three trains were run from the Fifth Avenue station of the Aurora, Elgin & Chicago Railroad,—at 12 noon, 1:00 and 1:30 p. m. The last train carried the majority of the picnickers. The returning trains left between 7:30 and 9:00 p. m.

Weather conditions were favorable and a programme which included a baseball game, foot races and dancing in the covered pavilion at the park was carried out sucessfully. In the baseball game, the Meter Department triumphed over the Accounting Department by a score of thirteen to six.

The whole of the arrangements were ably supervised and carried out by John C. Manley, to whom a great deal of the success of the outing was due.

The tickets for the outing were sold at fifty cents each. The total distance of the train ride was eighty miles.

A fine printed programme of the outing contained good illustrations of some of the staff of the Commonwealth Edison Company. This was liberally patronized by many local firms who showed some fine advertisements therein.

Commission News from New York.

The New York Public Service Commission, Second District, has approved of a plan for the consolidation of five corporations furnishing gas and electricity in Wayne county, providing the conditions imposed by the commission are accepted by the companies seeking to be consolidated. The companies are the Palmyra Gas and Electric Company, Newark Gas Light and Fuel Company, The New Light, Heat and Power Company, Lyons Gas Light Company and Wayne County Gas and Electric Company.

The new company will be authorized to issue $200,000 in stock in exchange for $245,000 present aggregate stock of existing companies, a reduction of $45,000 from the total of the combined capital stock of the constituent companies, and to issue bonds to refund at par $206,000 now outstanding of existing companies and to issue other bonds at 90 per cent of par value to discharge obligations amounting to $107,000, and still other bonds at the same rate for proposed improvements, $131,500, giving a total capitalization of $644,500. The commission requires present bonds to the amount of $89,000 used as security for obligations to be cancelled; $13,054.62 of obligations to be cancelled; $56,700.85 net surplus to be written off in the accounts.

The commission has also authorized the Bath Electric and Gas Light Company to execute a first mortgage upon all its property securing an issue of $250,000 of thirty-year, five-per-cent bonds and to issue at present $150,000 of these bonds; $44,500 of the bonds are to be sold at not less than eighty and the proceeds used in making extensions, betterments and improvements to the plant. The balance of the bonds authorized at this time are to be used to refund $100,000 of outstanding bonds and discharge bills payable in the amount of $31,990.15.

The New York Public Service Commission, Second District, has prepared and is mailing to all telephone corporations in the State a circular asking for information in relation to these corporations.

Chapter 673 of the Laws of 1910, which became a law June 25 and takes effect September 1, extends the jurisdiction of the Public Service Commission, Second District, to every telephone line which lies wholly within the State of New York and to that part within the State of New York of every telephone line which lies partly within and partly without the State of New York, and to the persons or corporations owning, leasing or operating any such telephone line.

The exception to the jurisdiction are corporations, companies, associations, joint stock associations, partnerships or persons having actually used for the public service in the State of a value not exceeding $10,000, or which do not operate the business of affording telephonic communication for profit.

Blanks are enclosed with the circular, which require an answer to the questions submitted on or before July 15. The questions asked are for the name, address, officers; towns, villages and cities in which the companies operate; kind of corporation, whether a person, partnership, association or an incorporated corporation; the capital stock issued and outstanding, showing common and preferred stock; a statement of the outstanding bonds of the corporation or association, their date of maturity, security, and rate of interest; if exempt from the provisions of the law statement must be made of the property in the State of New York actually used for public service, including poles, wires, switch-board, office furniture and other property and the value of each; and if the property is not operated for the business of affording telephonic communication for profit, a statement of the conduct of its operation must be shown in detail.

The information which the commission has on hand indicates that there are 1,106 telephone corporations in the State of New York. It is probable that considerably less than one-half will come within the jurisdiction of the commission because of the exemptions as to the companies having less than $10,000 in property or those not carrying on business for profit.

The Empire State Gas and Electric Association.

On Friday, July 8, the third of the association's sectional meetings for the present year was held in Schenectady.

Through the courtesy of M. W. Offutt, general manager of the Mohawk Gas Company and the Schenectady Illuminating Company, and of some of the officers of the General Electric Company, the meeting was held at the Mohawk Golf Club. The delegates, about sixty in number, were then entertained at luncheon in the golf club, following which they visited the works of the General Electric Company and the Mohawk Gas Company.

At the session in the morning, C. D. Haskins, of the General Electric Company, presented a short paper on the use of electricity in gas works, which provoked some little discussion, as there seemed to be a slight difference of opinion in regard to the advantages and disadvantages. Among other things it was pointed out that extreme care should be used in the wiring in case electrical motors or electric lights were used in gas works.

The question of twenty-five-cycle lighting was next taken up and E. W. Allen of the General Electric Company discussed the subject informally, after which numerous questions were asked him and the discussion became general.

In preparation for the meeting, the members had been asked to suggest subjects which could be taken up informally, but it was impossible to get through with more than a comparatively few of the questions suggested. Among these subjects were the Proper Size of Gas Water Heater to Sell for Use with Kitchen Boilers, Gas Heating on a Large Scale and Rates for Industrial Gas. There were four matters in regard to the use of electric fans and the discussion on this subject was quite general. It was pointed out that there were so many wrinkles in the use of electric fans that it would be advisable if somebody would prepare a pamphlet which could be distributed to the users of fans which would suggest to them not only the proper method of use for ventilation, but also many other ways in which the fans could be used during other seasons of the year.

Traction Litigation Settled.

The litigation in which the Metropolitan traction systems of New York City has been involved for the past three years has been virtually settled by a recent decision. In making the decision, Judge Lacombe of the United States Circuit Court directed William W. Ladd, receiver of the New York City Railway Company, to accept the offer of $5,500,000 in settlement of suits brought against the Metropolitan Securities Company and others.

The Boulogne Wireless Station.

An Illustrated Account of the New Directional System.

BY A. DE COURCY.

The method of directing wireless waves invented by the Italian engineers, Bellini and Tosi, has now found practical application, after having been perfected during the experiments which were mentioned in a preceding article. Following the very successful work which was carried on in the north of France at the experimental stations placed at Dieppe and Havre on the channel coast it became evident that the new system possessed many valuable advantages and that it was well adapted for practical use. Accordingly the French government made arrangements with the inventors in order to proceed with erecting a large station on this principle so as to confirm the above results and this on a larger scale than could be heretofore obtained. This led to the erection of the present plant at Boulogne, on the channel coast, which we illustrate in the present article from data which the inventors have kindly furnished. Due credit is also to be given to the Ducretet establishment at Paris, who carried out the construction of the station apparatus and notably of the radio-goniometer by which the waves are directed.

INTERIOR VIEW OF BOULOGNE WIRELESS STATION.

For a full explanation of the method employed, we refer to a preceding article published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of October 30, 1909, pages 838 to 841, and will merely state that the system comprises a station building in the center of which is erected a vertical mast or tower. From the top of the mast descend two aerials towards the ground, and the nearly horizontal wires entering the station go to form a triangular aerial as a whole. A second triangular aerial is mounted in a vertical plane at right angles to the former. Each of these has a separate fixed coil also crossed. The movable exciting coil revolves within these, and induces current in either of the fixed coils or the two combined, according as it is turned about. We thus have the two aerials acting so as to produce a resultant effect and the waves are directed out from the station at a certain angle, which is that of the movable coil. The greater part of the waves are directed to the front and the rear of the station.

The general appearance of the Boulogne station will be observed in one of the accompanying views. Mounted according to the principles of the Bellini-Tosi system, it consists of two crossed aerials, each of which has approximately the form of a trianagle. To carry out this method of mounting there are used four structural iron towers, these being placed at the four corners of a square whose sides are eighty meters in length. The height of the towers is forty-six meters. In order to hang the aerial wires there are stretched cross cables which connect the four tops of the towers and thus form four sides of a square. From the middle of each side, there is stretched an aerial system of several wires in parallel, which reaches the ground. Considering two opposite sides of the square, the aerial on each side is joined to the horizontal cable, so that at the top these two aerials are spaced eighty meters apart. The two aerials, however, are spaced out towards the ground, so that at the bottom the ends lie at a distance of 127 meters. From the lower point there are cross wires which run nearly parallel to the ground and connect with the station, this latter being located at the center of the square. The cross-connection thus leads from the building to the foot of each aerial, so that it will be seen that the general idea of a triangular aerial is carried out here, except that the triangle is open at the top. M. Tosi states that in theory it would have been preferable to use a pair of vertical antennae joined at the bottom, instead of the present form, but in practice it is shown that the upper points of the antennae can be brought nearer together without materially changing the results, and we have in such case a great advantage in not occupying too great an extent of ground by the towers and their guy-wires. The remaining two sides of the square are provided with a pair of antennae which are identical in form with the preceding, so that the two sets of aerials are made to lie in perpendicular planes, which is required by the present method.

Each aerial which descends to the ground on one side is made up of six copper wires hung from the horizontal cable, and these wires are stretched parallel to each other at distances of four meters, being brought to the ground where they are then connected together electrically. The lower ends of the copper wires do not reach the level of the ground, but stop at a height of eight meters above the soil. The aerial wires proper do not show in the photograph, unfortunately. Owing to the sag of the top horizontal cables, the actual height of the aerial is about forty-four meters from the ground. The distance between the lower ends of the aerials is 127 meters, owing to the spread which is given them, this being at an angle of thirty-two degrees.

The wave-length which is chosen for the station is 300 meters, and the distance between the opposite antennae which gives the longest range according to theory is 150 meters. It was considered that in the present case it would be sufficient to have the lower ends of the antennae spaced at this distance, or not much less, and the tests which were made at the plant show that this idea was correct.

Considered as a whole, such an aerial consisting of the horizontal wire and two upright wires has a proper wavelength of 900 meters. In order to be able to radiate or receive a wave of 300 meters the aerial is excited from the third harmonic.

The inventors made a series of very careful tests in order to measure the amount of energy which was emitted from the present directed system, especially in order to compare this with the results obtained with an ordinary aerial, so as to bring out the advantages of the new system. This was especially needed, as the idea prevailed that the range of the directed wave system was less than in the ordinary case for the same amount of power used.

In order to make the measurements, there was set up an experimental post at the Grande Armée column located at 1.8 miles from the Boulogne post, and here were made tests as to the directing of the waves, as well as to find the range. The energy was measured by a Duddell thermo-galvanometer. This distance is equal to ten wave-lengths and is enough to bring the second post outside of any local influences upon the galvanometer which might be due to the Boulogne station, so that very accurate results could be obtained.

It was desired to compare the directed system with the single antenna system in the first place. Using the directed aerial set, with a current represented by 175, there was secured a deflection of 113 degrees on the galvanometer. Employing a single antenna (using one of the present antennae for this purpose) there was found a deflection of thirty-five degrees, the current value being represented by 240. As the deflections vary as the square of the current for equal currents in the two systems the ratio of the two readings would have been 113 and nineteen; in consequence the energy emitted by the directed system in the direction of the communication is practically six times as great as that which the ordinary system will give. Such a result speaks greatly in favor of the directed system.

It might be objected that an antenna of the above type when employed as an ordinary vertical antenna and oscillating with the third harmonic is not the best type of vertical antenna which can be used and that one could secure better results with a vertical antenna of the usual kind and excited in the ordinary way.

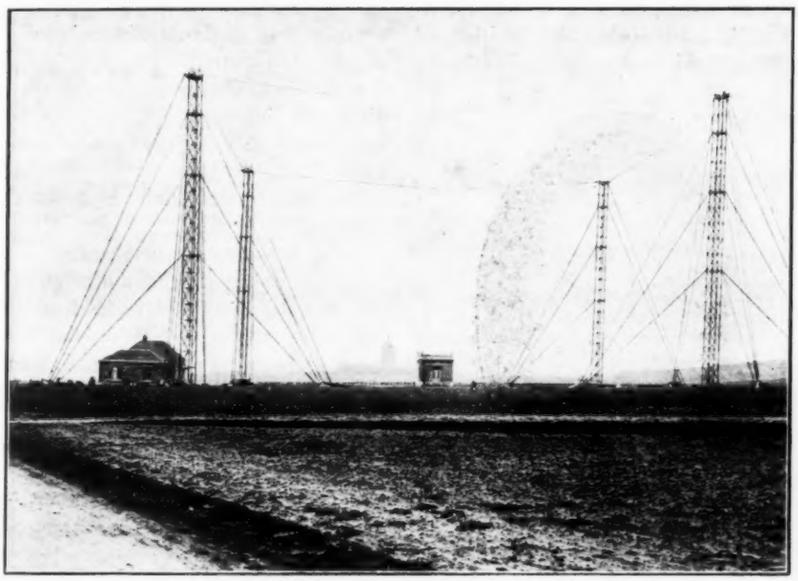
In order to meet this objection, there was installed at the Boulogne post along with the former outfit a vertical antenna of the ordinary kind which had the same height as the sloping antennae. With it was used the fundamental wave of 300 meters length and not the harmonic, as in the former case. A series of comparative measurements between the two systems, using equal currents in each case, showed a deflection of thirty-five degrees for the directed system and only seven degrees for the ordinary system. The reason for this lies in the fact that while in the vertical antenna the loop or maximum point of the current wave lies within the station building and forms part of the secondary of the Tesla coil, in the case of the directed aerial the loop of the wave is at the base of the antenna, and this base itself lies at eight meters above ground, so that it is quite free. It is thus natural that the latter should give the best radiation.

The indications given by the Duddell galvanometer were confirmed by a series of long-distance experiments which show quite clearly that the Bellini-Tosi system has a longer range than the usual system.

Such tests were carried out with a post lying at a comparatively short distance, the Folkestone station at twenty-five miles distance situated across the channel on the English coast, as well as with stations situated

at greater distances. In the latter case messages were sent to the Mediterranean posts belonging to the French Government at Marseilles and at Algiers. These posts were always able to receive the directed waves with very clear results, while with the ordinary method the reception was much less distinct. These tests were very conclusive in favor of the new method, owing to the distance covered, which was nearly 1,000 miles in the case of Algiers. But a small amount of power was used at Boulogne during these tests, this being not over 500 watts in the primary of the induction coil, and it will be remembered that the wave length was only 300 meters.

As regards the amount of energy which is radiated in different directions from the present plant, the results obtained at the neighboring experimental post with the Duddell galvanometer give a diagram which is of the same form as was obtained in the preceding tests.



AERIAL SYSTEM AT BOULOGNE WIRELESS STATION.

Seeing that it is now established that the station designed on the Bellini-Tosi system has a greater range than the ordinary posts and at the same time that it has the advantage of being able to direct the waves instantly to various points by the use of the radio-goniometer, it is evident that its use is to be preferred to the ordinary type of station in every respect. The present tests, which were very carefully carried out by the inventors under the general supervision of the French postal and telegraph administration, seem to be an undoubted proof.

It is also to be noticed that the present method does not use a ground connection for the aerials, and the tests showed that the use of earth connection gave an advantage and on the other hand a loss which were about compensated mutually. The advantage comes from the increase of the current in the vertical antennae connected to ground when compared with the insulated antenna, while the loss is represented by the energy absorbed on account of the resistance of the earth. This absorption of energy by the earth is noteworthy, and has been made evident by the recent work of Sir Oliver Lodge and M. Tissot. There are cases, however, in which the ground in certain countries is a very bad conductor and here the usual systems are found to give imperfect results. It will be of great help to use the new method in such cases as it will overcome this disadvantage at once, and the inventors believe that it can be employed even in the most arid deserts.

The Boulogne station lies in a position in which a post of the usual kind could only be worked at rare intervals without being troubled by other transmissions, seeing that it lies on the channel coast and there are both the stations on the French and the English sides of the channel in the immediate neighborhood. For this reason the Bellini-Tosi system is the best in order to give a constant connection between Boulogne and the vessels in these waters.

From standpoint of navigation, the present post has a special use, this lying in the fact that signals are exchanged with the vessels which come within range, and they can be thus given the readings of their position during foggy weather when the coast is invisible. In fact, seeing that the radio-goniometer at Boulogne allows of determining the position of a sending post within an approximation of one degree, the station receives the messages from a given vessel and after finding the angular position it can inform the vessel to this effect and such can be done at any moment. By repeating this operation according to the well-known methods of navigation, the vessel is able to find its position during foggy weather, which is impossible by any other means.

Receivers for Telephone Company.

W. C. Handlan and J. W. Ewing have been appointed receivers for the National Telephone Company by Judge A. G. Dayton, at Phillippi, W. Va., upon action taken by Andrew J. Howard, of Indiana, a stockholder of the company.

In the application it is alleged that the Continental Telephone Company procured $10,000,000 in stock of the National without any consideration, that the officers of the National are to be turned out and its business conducted along other lines than those formerly pursued.

Raise Recommended for Telegraphers.

The board of conciliation which was appointed to settle the difficulties between the telegraphers of the Grand Trunk Pacific Railway of Canada and the operators, recommended a wage increase of from twenty-five to thirty-five per cent. Provision was also made for shorter hours, better classification and promotion for merit and service. Up to July 7 the company had not announced whether the award would be accepted or not.

Wireless on German Vessels.

The North German Lloyd Steamship Company has recently ordered Telefunken wireless equipment for fifteen of its ships on the Eastern Asia and Australian lines, and other German steamship companies are rapidly equipping their vessels with wireless.

Canadian Electric Associational.

Convention at Muskoka Lakes, Ont.

The twentieth annual convention of the Canadian Electrical Association, held at the Royal Muskoka Hotel, Muskoka Lakes, Ontario, July 6, 7 and 8, proved unquestionably the most pleasant and instructive meeting yet held by this flourishing association. The decided innovation of gathering in convention at a summer resort was most successful and never have the electrical interests come together under more pleasant circumstances and in surroundings more delightful than those afforded by the Royal Muskoka district. Particularly successful were the business sessions; the attendance during the reading of papers and during discussions could not have been better, and this was largely due to the immunity from those distractions attendant to meetings in the larger centers.

The papers this year were above the average and in this respect much credit is due to Messrs. R. G. Black and A. L. Mudge of the Papers Committee.

The weather throughout was ideal and when business sessions permitted, the delegates enjoyed to the utmost the natural beauty of the surroundings. Fishing, golfing, tennis, bathing, boating and baseball were all indulged in.

An enthusiastic crowd was on hand for the aquatic sports and regatta, Wednesday afternoon. These were held on an ideal course. Three cups for competition were generously donated by Frederick Nicholls, of Toronto. Mr. W. A. Bucke of Toronto made an efficient starter. The results were as follows: Ladies' single canoe, (1) Mrs. Morden, (2) Mrs. M. A. Blauvelt, (3) Miss Black; swimming, (1) H. F. Strickland, (2) A. L. Mudge; mixed doubles, (1) Miss M. A. Blauvelt and C. C. Bothwell, (2) Mrs. Squire and A. V. Gale; single canoes, (1) A. V. Gale, (2) S. T. Farum, C. C. Bothwell tied; tilting, (1) W. P. Roper and A. L. Mudge.

Thursday afternoon, the manufacturing and operating men lined up for a scheduled baseball game. The former, after a fierce struggle, won out, 10 to 4. Geo. C. Rough, of the Packard Electric Company, captained the winners, while L. V. Webber, of the Toronto Electric Light Company, was in charge of the power men.

W. W. Freeman won the golf tournament, his nearest competitor being R. Edwards, Jr.

Thursday evening the members and visiting friends gathered in the spacious and tastefully decorated dining room of the "Royal Muskoka," where the annual banquet of the association was held. The presence of representatives from the prominent American societies and a sprinkling of guests from England lent additional character to the proceedings. P. S. Coate, president-elect, filled admirably the position of chairman and toastmaster. Frederick

W. N. RYERSON,
Retiring President of the Canadian Electrical Association.

Nicholls, in a stirring speech, replied to the toast of "Canada, Our Country," L. J. Belnap responded for the manufacturers.

Both Col. Street and C. A. Littlefield made excellent speeches in replying to "The Central Station Interests," and were most cordially received.

"Sister Societies" were spoken to by W. W. Freeman, President National Electric Light Association, T. C. Martin, secretary, and Chas. F. Scott, Past-President of the American Institute of Electrical Engineers. Harmony and good fellowship reigned supreme, and one could not but feel that the union of American and Canadian electrical interests could bring about only one result—the advancement of the interests of both. In his speech, T. C. Martin eulogized the work of Mr. Nicholls while connected with the National Electric Light Association. Chas. F. Scott was impressed with the wonderful work being done by the company branches of the National Electric Light Association.

During the evening prizes were presented to the winners in Wednesday's regatta, Mrs. Doane of Cleveland graciously assisting Mr. Nicholls in this pleasant task.

The toast to "The Ladies" elicited eulogies from W. A. Bucke and A. A. Dion. The presence of the ladies in such pleasing numbers during the convention was undoubtedly responsible in a great measure for the enjoyment of the occasion. At the conclusion of the dinner an impromptu dance was held and thoroughly enjoyed until a late hour.

The registration totalled almost two hundred.

ELECTION OF OFFICERS.

On Thursday afternoon a meeting of the executive section was held and the following officers were elected for the ensuing year: President, P. S. Coate, manager Chatham Gas Company, Chatham, Ont.; first vice-president, E. A. Evans, Chief Engineer, Quebec Railway, Light & Power Company, Quebec, P. Q.; second vice-president, W. L. Adams, Ontario Power Company, Niagara Falls, Ont.; secretary-treasurer, T. S. Young, Toronto; managing committee, J. J. Wright, R. G. Black, R. F. Pack, L. V. Webber, A. L. Mudge, D. H. McDougal, W. N. Ryerson, A. A. Dion, F. A. Chisholm, W. L. Bird.

The naming of all standing committees and the decision regarding the next place of meeting were both left to the incoming executive. In the latter connection, Ottawa is prominently mentioned, and in all probability it will be in that city that the 1911 convention will be held.

WEDNESDAY MORNING SESSION.

The first session of the convention was opened with P. S. Coate, first vice-president, occupying the chair. President W. N. Ryerson sent regrets at his inability to attend. During the morning a paper prepared by Mr. Ryerson on "Some Practical Considera-

tions Concerning Contracts for Lighting and Power Service" was read by Mr. Coate, taking the place of the regular presidential address.

CONTRACTS FOR LIGHTING AND POWER SERVICE.

In his address President Ryerson departed from the usual practice of reviewing electrical affairs and devoted himself instead to a discussion of some practical considerations concerning contracts for lighting and power service. While the amount of money involved will naturally affect the amount of care exercised in drawing up contracts, they should in general be as brief and clear in their terms as possible. Mr. Ryerson discussed the following twenty-three points that are more or less important in drawing up the document: (1) Term of contract—should be fairly long in large contracts and should contain privileges of renewal. (2) Price or consideration—should be expressed in the simplest possible language and unless on flat-rate or meter basis, should contain a practical illustration of a sample bill under assumed conditions. (3) Uses to which current is to be put—should be specified in general terms at least. (4) Point of delivery—should be definitely stated to avoid misunderstanding as to responsibility. (5) Meters—state the type (whether integrating, curve-drawing, maximum demand, or combination of these) and who is to furnish them. (6) Access to customer's property—should be permitted at all legitimate hours. (7) Balancing of phases—a penalty for unbalancing is sometimes desirable. (8) Power-factor—a penalty for power factors below a certain minimum is frequently inserted; the desirability of this and No. (7) is debatable as the proper selection and adaptation of apparatus, motors in particular, to the work to be done usually results in a fairly good power-factor and no unbalancing. (9) Penalty for non-payment of bills—better to charge at a higher rate beyond a certain date than to give discount before that date. (10) Penalty for interruption to service—almost unavoidable in large contracts to other public utilities, but should not apply in catastrophes or during necessary work on the lines at reasonable hours. (11) Excess power—beyond that contracted for should be secured from the power company if its generating capacity permits. (12) Arbitration—the exact procedure in disagreements should be defined. (13) Supervision of consumer's apparatus—should be of a general character rather than detailed, conformity to local or underwriters' wiring rules being specified in small contracts. (14) Definition of delivery—maintenance of agreed voltage and frequency at point of delivery should suffice. (15) Voltage of supply—better specified as between two limits than any fixed value. (16) Frequency—should be stated as to normal value and that it will not vary so as to prevent the commercial operation of consumer's apparatus. (17) Liability—of no value unless mutual. (18) Definition of terms—such as kilowatt-hour, horsepower-hour, etc. (19) Assumption of liability to successors and assigns—stipulated except in small contracts. (20) Sole use of generating company's power—except where peak-load or breakdown service is furnished by power company. (21) Delay in delivery or use—no liability on either side when due to causes beyond its control. (22) Deposit or other guaranty—desirable with small consumers whose financial standing is unknown. (23) Lamp renewals—if by generating company, should be clearly stated and on what basis. In conclusion Mr. Ryerson advocated strongly that, however simple the contract be, it should state explicitly what the rates for the service are; also that the established rates be adhered to strictly and be alike to all.

In the discussion following the reading of this paper, R. F. Pack took issue with the author's methods of facilitating payment of accounts by exacting a penalty for the non-payment of accounts when due, rather than giving a discount to accelerate these payments. In support of the latter method, Mr. Pack pointed out that this system would be less likely to antagonize the customer. The speaker also considered that Mr. Ryerson's "mutual liability" clause was a very dangerous one to insert in any power contract.

After the reading of the minutes the secretary-treasurer, T. S. Young, presented his annual reports. During the past year the Association has flourished. The membership has been largely extended and now amounts to about

P. S. COATE,
President-Elect of the Canadian Electrical Association.

five hundred. The financial conditions also showed very gratifying results.

C. A. Littlefield, of the New York Edison Company, read the next paper, on "The Commercial Agent and the Community."

THE COMMERCIAL AGENT AND THE COMMUNITY.

This paper dwelt on the importance of the new business department and the personnel of its employees. The author took the New York Edison Company as an example, and mentioned the various sub-department coming under the head of the new business department, and described the scope of work and policy of each sub-department. Among the departments considered were the following: Wholesale and new-building bureau, private-plant bureau, power bureau, sign bureau, automobile bureau, heating bureau, follow-up bureau, engineering bureau, district offices, and complaints. Referring briefly to the subject of rates, it is the opinion of the author that a simple, easily understood rate system, devoid of "minimum," "standby" or "readiness to serve" charges, is one that strongly appeals to the public. The paper also deals quite fully with the needs of the city as relates to the central station and the attitude of a company's employees.

This paper was discussed at some length. A. A. Dion, after expressing his appreciation of this paper, pointed out that the plans outlined applied generally to the needs of larger central stations, rather than to those found in Canada. He felt some surprise at the decided opinion expressed by the author on the question of "stand-by" charges included in rate making; his opinion being that all electric light companies were agreed that a readiness to-serve charge was absolutely necessary by reason of the introduction of tungsten and other high efficiency lamps. The speaker hoped to see Mr. Littlefield's paper discussed further when the question of rates same up later.

WEDNESDAY AFTERNOON SESSION.

A paper on "The R. C. M. Electric Service Rate System," prepared by S. Bingham Hood, of the Toronto Electric Light Company, was read by S. E. Doane of Cleveland. The vital importance of the question of "rates" to central station interests was most forcibly demonstrated by the keenness of the discussion.

THE R. C. M. ELECTRIC SERVICE RATE SYSTEM.

The first part of this paper is devoted to an interesting review of the early history of rate making. The difficulties encountered with the early types of meters were related. The cost, trouble and unreliability of these meters prevented their adoption by most of the smaller stations, and also led to retaining on a flat rate many desirable or influential customers on the larger systems. The later development of the watthour-meter placed in the hands of the central-station management an instrument which was accurate within commercial limits. The demand for such meters led to the reduction of manufacturing costs, which permitted their use by small companies, and within a short time almost entirely eliminated the flat rate system of charging. With the development of more reliable central-station apparatus and increase in size of generating and transforming units more effort was expended toward increasing the connected load in proportion to population served. The development of variable rate system was gone into fully, and the Wright demand system, the two-rate-meter systems, and the Doherty system described. The paper then review the tungsten lamp situation, pointing out emphatically that the reduction in revenues caused by the advent of the tungsten has made it necessary to revise rates so as to be able to push these lamps without serious consequences. The rate adjustment, interrupted by the chaotic conditions of lamp development during the past few years, is now being given serious consideration by nearly all the larger companies. All systems which appear to meet with favorable consideration appear to have as their base the essential features of either the Wright Demand or Doherty Systems, with modifications as will meet changed

conditions due to introduction of the tungsten lamp. Working along these lines, the writer has developed a differential rate system composed of a readiness-to-serve charge, a consumers' charge, and kilowatt hour or meter charge, calling same, for ease in distinguishing from other methods, the "R. C. M. System." The primary, or "readiness to serve," charge of this system is obtained by dividing the sum of all annual fixed and operating charges which vary with size of plant, by the total kilowatt capacity of the generating equipment. These charges must include all those necessary to maintain and operate the entire equipment without load or actual delivery of current to the consumer. The intermediate, or "Consumers' Charge," of the R. C. M. system has been recognized as a separately apportioned charge by Doherty, but finally included in the readiness to serve rate of his system. This charge includes all those expenses which vary directly with the number of consumers on the system, and, consequently, should be made a separate charge from the primary one. Unless this is done the very small consumer gets an unearned advantage at the expense of the larger ones. This discrimination is against the objects of the proposed system, which is to give to every consumer, irrespective of his demand or total consumption, the very best rate which his conditions warrant. The third, or kilowatt-hour "meter charge" of this system covers all charges which vary directly with the kilowatt-hour output of the system. This is subdivided into two parts. First, that covering current supply only; and, second, that covering lamp renewals. The first part of this charge is used for power users only, under which heading is included all customers who own and maintain their own utilization equipment, irrespective of whether it be lamps, meters, or other devices. The two divisions are combined and applied to those consumers purchasing light from the company. This purchase of light to include in addition to operating current, the renewal and maintenance of the utilization equipment, which includes lamps, shades and reflectors, the supporting fixtures being owned outright by the consumer. In order to apply this system of rates, the first requirement is naturally to determine the demand of the consumer. The R. C. M. system considers only those rooms which can be classed as "living rooms," and neglects entirely those in which only occasional light is required, or lights in small units as compared to floor space covered. A further division is made between rooms generally occupied by a large proportion of the family and those usually occupied by individual members. To obtain this proportion the actual living rooms on the main floor are taken at the maximum rate, based on a consumption of one watt per square foot of useful floor space on a carbon filament lamp basis. By useful floor space only that portion of the room requiring light, or, roughly speaking, the area covered by the largest rectangle which could be placed in the room is considered. The actual living rooms as scheduled would be charged for "readiness" at a fixed price per square foot of floor area, and not at a price per watt. The rating of one watt per square foot will give ample light with carbon lamps, so that price per watt and per square foot will be the same.

To meet the case of tungsten lighting the author proposes giving the consumer these lamps and proper reflectors for same, provided he supplies the correct design of fixture, and make no additional charge other than the regular rates. The allowed wattage for tungsten lamps shall not exceed one-half that required for carbon filaments. The lamps to be not less than forty watts or over 100, and are not to be installed in fixtures which are improperly designed for use of scientific glassware. This will practically limit their use to the main rooms on lower floor and possibly one room on the floor above. For this service the consumer pays us just double that of the readiness charge calculated on a tungsten basis. This surplus, together with the renewal portion of the meter charge, compensates the company for cost of tungsten renewals, and makes tungsten residential lighting the most profitable of any obtainable load. The consumer profits from this in obtaining more initial light and much more useful light, due to proper diffusing shades and reflectors, and saves one-half on his variable meter rate charge. In addition, he gets expert attention to his equipment which his knowledge will not ordinarily permit him to obtain should he undertake his own tungsten installation. A further advantage is the ability of the consumer to return to plain carbon lighting, with or without the knowledge of the company, without a readjustment of rates. For commercial lighting the system is very similar to the residential methods, excepting in the method of determining the maximum demand. This demand is assumed to be 100 per cent of the connected load of that portion requiring regular lighting during business hours. Lights in rooms or basements not used generally for regular business and requiring but momentary lighting at infrequent intervals, are not to be counted in the readiness to serve rate. The readiness to serve area should include the actual floor space to be lighted, which would exclude such space as used for wall shelving, etc. The base rate would apply uniformly to this useful area, irrespective of the amount of light used, with a limit of an average of one watt on a carbon basis and one-half watt for tungsten per square foot. This will allow for drop lights over desks and lamps in show cases, as the general illumination in the vicinity of such fixtures need not be as great as otherwise. For show window lighting the watts per square foot can readily be increased by a slight sacrifice of the intensity of interior. These windows should be permitted the extreme maximum and every reasonable allowance given in order to encourage long hour burning.

R. G. Black made a valuable contribution to the discussion. The underlying principles in rate-making could not be discussed in their entirety, he felt, but the advantages and disadvantages could be pointed out. "In order to cover any system of rates you require a great many different contracts or schedules and in that way you make easy the steps from one class of customer to another."

R. F. Pack discussed the pros and and cons of the new system and suggested that there would probably be a strong sentiment against the adoption of this form of a readiness-to-serve charge. He feared loss of business to the gas companies through it, and felt that it would be advantageous, perhaps, for all companies, both municipal and private, to ask government commissions to fix their rates.

Leonard Andrews, of London, criticized this readiness-to-serve charge, or flat charge based on floor space. In his experience the light required per square foot varied according to conditions of rooms, decorations, etc. The basis of the rate was not new but had been thoroughly investigated in Great Britain. Mr. Andrews, pointed out also that the small customer is considered a valuable asset by every electric light company and therefore it would be a mistake to introduce complicated rates which every customer could not understand.

C. A. Littlefield felt that while in many respects the system outlined was ideal, yet it was very complicated and would not appeal to the public but would rather drive away business. The small customer was a valuable asset not so much from a dollar-and-cent standpoint as for what his influence represented.

A. T. Holbrook's paper, "The Residential Lighting Field and How It Can be Cultivated," was next taken up by the meeting, and at the conclusion of the reading of this paper a spirited discussion took place.

RESIDENTAL LIGHTING FIELD: HOW IT CAN BE PROFITABLY CULTIVATED.

This paper reviews the status of the residential lighting field, pointing out that less than ten per cent of the residences in central-station towns and cities of North America where electric-light plants are situated, are connected with the service of the electric lighting company, and that this list of non-consumers is made up largely of homes which are already wired, and which have discontinued service for various reasons, mainly dissatisfaction with the methods of charging for current. The paper briefly discusses the various schedules of rates for residence lighting, and mentions the advantages and disadvantages of each. Until the rate based on a straight per kilowatt controlled demand charge on a yearly basis was tried in Hartford, it was believed that it would be necessary to let the residence business work itself out as best it might with the rates which were available. The opinion is advanced by the author that residence lighting is or should be a wholesale method of selling current, and it is not from the largest house in the community but from the smallest that the net profits are made. A rate advocated by the writer which he claims will influence residential lighting customers is based on a fixed charge of not less than $120 per kilowatt per year of actual station demand. On a monthly basis it is equivalent to one cent per watt per month. This return of $120 per kilowatt per year is a larger return than most companies receive from business of a so-called better class. Tungsten lamps of standard voltages are used, and the current sold subject to use without variation of cost during ordinary lighting hours. This demand is rendered definite by the use of an excess indicator which is installed for that purpose. The function of this indicator is to serve notice on the customer when he has exceeded his demand, and to safeguard the lighting company against any unfair treatment. The ordinary hours of burning are also insured on account of the renewal cost of the tungsten lamps, but no condition of abuse would fail to give a high average rate of income. Wherever this rate and method

of charging is put into effect it appeals at once to that class where the average household income is between $600 and $1,200 per year. This class of customers average $1.50 per month, and range from $1 per month up. A house having six rooms with a total of nine twenty-five-watt lamps may contract for four and use up that number for $1 per month, where a larger home will be compelled to use eight or nine lamps out of a total installed of from twenty to thirty-five, at a cost of $2 or $2.25 per month. In addition to this rate, the writer advocated co-operation with wiring contractors in establishing fixed and definite charges for house wiring; co-operation with the public journals in publishing notices of lighting interests, and lastly, co-operation with the manufacturers of electric appliances.

R. G. Black, of the Toronto Electric Light Company, said that his company had long ago recognized that they were not getting their share of customers among the poorer classes, because of the lack of special rates. If the methods mentioned in this paper of Mr. Holbrook's were satisfactory, he could see where, in large cities, at least, it would be possible to largely increase the revenue along the lines suggested.

Mr. Holbrook later gave several instances of where this system was being employed and with every satisfaction.

C. A. Littlefield stated that he believed that Mr. Holbrook was misinformed when he expressed the opinion that less than ten per cent of the residences in central-station towns and cities were using electric light. He questioned if it would apply to the average city, but at the same time recognized that a large number of possible customers were not being reached because the proper rates were not employed.

I. H. Wright asked regarding the experience gained by the delegates in making collections from the small customers. The meeting generally considered that the small consumer represented the mechanical class who were the most reliable customers a central station could possess.

THURSDAY MORNING SESSION.

The slight rainfall during the night rendered the surroundings much more pleasant for the members. A. A. Dion, Chairman of the committee appointed to investigate the question of affiliation with the National Electric Light Association, first addressed the meeting. His committee had really nothing definite to place before the delegates. The whole matter was being taken up by the Canadian Association, and not at the solicitation of those delegates of the American Association who were present, although he believed that the latter association would favorably view any move toward amalgamation. Mr. Dion stated that in the change the Canadian Electrical Association would retain its own identity with some freedom of action as at present, but would pay dues to the National Electric Light Association. He considered that their revenue would be even better under the new regime than at present. Frederick Nicholls, a former prominent official in the American Association, did not favor the amalgamation. It would, he foresaw, bring about the disintegration of their Canadian society. No decision will be made in this matter until a later meeting of the members.

Chairman W. A. Bucke, of the Central Station Statistics Committee, reported a lack of co-operation on the part of central stations that made the work of his committee extremely difficult and arduous. General satisfaction was expressed by the members regarding the progress made.

Leonard Andrews stated that in England they had been gathering similar statistics for fifteen years and now had much information of value. A competitive spirit should, if possible, be stirred up among the different central station managers.

R. F. Pack, chairman of the Committee on Uniform System of Accounting, read an interesting report. This is apparently a feature of central-station management that is receiving more attention than was formerly the case.

ACCOUNTING SYSTEM REPORT.

The scope of this report is limited to suggesting a classification of accounts for adoption by the Canadian Electrical Association. The committee carefully examined the classifications ordered by the Public Service Commission in the States of New York and Wisconsin and has compared these classifications with that adopted by the National Electric Light Association. These systems are identical in principle. Other States in the Union will shortly appoint Public Service Commissions to regulate public utilities, and these Commissions will, undoubtedly, order accounting systems similar to those already so widely in use. The committee reported that it is not expedient to suggest a classification involving a radical departure from methods which have already proved successful, and has decided, therefore, to submit to the Canadian Electrical Association the classification of accounts adopted by the National Electric Light Association. This includes the construction of fixed capital accounts, classification of construction and equipment accounts, classification of expense and income accounts, income accounts and income classification.

A paper prepared by A. S. Loizeaux, of Baltimore, Md., entitled, "Accessories Which Lend to Continuity of Power Supply," next occupied the attention of the meeting. The paper was read by A. A. Dion, who, in closing, emphasized the author's remarks regarding the public's appreciation of an assurance of a continuity of service, even at the expense of a higher rate for such a service. Municipal plants today were frequently claiming lower rates for power, but this was no indication that the private concerns would lose any of their business.

The general plan of the paper was also dealt with by A. L. Mudge. He believed that the information given applied more generally to larger plants and where systems are more complicated.

"Notes on Transmission Line Regulation," by Paul M. Lincoln was next read in the author's absence by Chas. F. Scott.

TRANSMISSION LINE REGULATION.

With alternating current, regulation depends upon power factor of the load, leakage, capacity and reactance of the line, as well as resistance and current. For simplicity, leakage and capacity are neglected. For lines 300 miles or greater in length, capacity should be considered. Diagrams are given to show the effect of power-factor on the regulation. A formula is given for the exact calculation, but an approximate result can be obtained by projecting the total impedance drop upon the generator voltage in the diagram. To facilitate this, tables are given of ratio of reactance to resistance for various sizes and spacing of wires at 25 and 60 cycles. A third table gives factors for getting total drop for any ratio and any power-factor. Examples are given to show the error caused by using the approximate method and neglecting capacity.

Mr. Scott pointed out to the non-mathematical delegates that Mr. Lincoln's tables enabled them correctly to obtain proper sizes of wire for power circuits. A. A. Dion pointed out another instance of a useful table in one devised recently by Prof. Herdt, of McGill University, Montreal. He considered both of these methods very good short cuts and both simple and useful methods of solving problems that are coming up every day.

Mr. Dion, as chairman of the committee on grounding of secondaries, then stated that his Committee was not prepared to make a very tangible report. Prof. Steinmetz advocated the grounding of all secondary circuits no matter what the voltage. Personally he took issue with this opinion. He favored grounding of circuits up to 150 volts, but above that he believed it should be left to the judgment of the individual and would also depend upon local conditions. He was surprised to

note that in the experience of the American neighbors that out of 285 companies who had been approached on the question and had replied, 150 did not ground their secondary systems at all.

FRIDAY MORNING SESSION.

The first paper was read by Sidney G. Redway, on

"HOW TO INCREASE THE STATION LOAD."

In his paper Mr. Redway outlined modern methods which, if followed, he believes will result in getting new business for the central station. A systematic canvass must be inaugurated no matter how small the plant. The attempt to combine the offices of engineer and business manager of the station is a big mistake.

In the animated discussion following this paper the consensus of opinion favored the suggestions offered in Mr. Redway's paper.

L. V. Webber, chairman of the committee on Meter Installation, Care and Testing, next reported and considerable discussion was evolved.

REPORT OF COMMITTEE ON METERS.

The report emphasizes the importance of maintaining efficiency of meters. Meters which do not receive attention usually become slow. Attention is called to the Electricity Inspection Act, which requires a one-kilowatt dial for testing purposes. For residential lighting, meter capacities of twenty-five to fifty per cent of the connected load are recommended; for other buildings, one hundred per cent; with circuits divided and run through several small meters for large installations. The position of the meter is also considered, and meter-reading is given a great deal of attention, accuracy and regularity of reading being especially emphasized. The government test number is preferable to the manufacturer's number in keeping records. Meters should be tested both before and after installation. The first test should be preparatory to the government test. The government inspector has instructions to test for creeping, and beween one-quarter and full load the tolerance is three per cent. Periodical tests should be made after installation, more frequently on the larger sizes. For induction meters, periods of twelve to eighteen months for residences, and six to twelve months for business districts are recommended; for commutator meters, six to twelve and three to twelve months respectively, except for 500-volt meters, where two to four months is recommended. Some suggestions are given in regard to handling complaints. For testing meters in service three methods are mentioned, using respectively the rotating standard, indicating instruments and standardized resistances. The committee favors the first of these, and points out its advantages. Tests should be made at three loads: one-tenth of the connected load, normal load and total connected load. The normal load is given a weight of three in computing the average accuracy. The subject of metering under two-rate contracts is given considerable attention, and the double dial meter is favored where two rates apply for different periods of the day. One advantage that the two-dial meter possesses over maximum demand meters is that the periods during which the customer shall pay the high rate or the low rate, as the case may be, can in each individual case be definitely pre-determined. In the case of the maximum demand meter on domestic lighting the customer's peak may coincide with the power house peak, but owing to the increasing use of electric irons, toasters and the like, the residential maximum demand may occur at any hour during the day, and, therefore, this indicator is of little effect. The committee believes that the varying conditions of the light and power business for large installations are well met by this type of meter, and that satisfactory instruments can be obtained. Lighting companies, having only a lighting load, will set the pointers of their double-dial meters to correspond with the period of their peak load, and as the apparatus can be easily understood by any consumer of ordinary intelligence, it is pretty certain that the effect of the extended use of these meters would be to level out the peak and raise the lower parts of the load curve; for private consumers, realizing that before and after a certain hour in the evening they can get their energy at a much cheaper rate, will practice economy during the critical period, and may more than make up afterwards by using their light freely during the cheaper time.

Maximum demand meters are then considered. These may be used in three ways: (1) The maximum demand for the month may be used as a basis for the rate per kilowatthour. (2) The demand may be made the basis for a service charge in addition to the charge based on meter-reading. (3) The demand may determine the portion of the meter registration for which a higher rate is paid, the balance being at a lower rate. The advantages and disadvantages of the Wright demand meter are considered, and comparison made with graphic recording meters, which are accurate to one per cent. The report concludes with a consideration of the keeping of records and statistics.

Harold S. Brown read a paper on "Electric Heating and Cooking Appliances."

This was extremely interesting and took the nature of a comparison of electrical apparatus with gas-operated machines. In every instance the economical and efficient operation of the former made their use advisable. Comparative tests and figures were shown. Mr. Brown also reviewed the progress made towards perfecting the different electrical appliances.

FRIDAY AFTERNOON SESSION.

At the concluding session of the convention two very well prepared papers were read and discussed, "The Tungsten Lamp as a Factor in Modern Street Lighting," written by C. E. Stephens, was the first on the programme.

TUNGSTEN LAMP AS FACTOR IN MODERN STREET LIGHTING.

Mr. Stephens opens his paper with the statement that, as the intensity of illumination is proportional to the light intensity of the source and inversely proportional to the square of the distance from the source, for a given minimum illumination doubling the distance between lamps requires each lamp to have four times the light flux and therefore each mile of street two times the energy. Conversely, reducing the distance between units reduces the energy required to produce the same minimum illumination; at the same time the increase in number of units affords a more uniform light distribution. The requirements for good street lighting are: Uniformity of distribution, the ratio between maximum and minimum illumination not exceeding ten to one; good diffusion and low intrinsic brilliancy of light source, obtainable by intelligent use of appropriate shades and reflectors; absence of sharp shadows. The desirable characteristics of a suitable lighting unit are: (1) The maximum intensity of the light unit should be from fifteen to twenty degrees below horizontal and decrease rapidly above and below this angle; (2) the total light flux from a single unit should be as small as conditions will permit, i. e. for a given intensity of illumination the maximum number of small units should be used and spaced at frequent intervals; (3) the light should be diffused or emitted from a large area; (4) the lamp should be supported at the maximum practical height above the street surface, particularly if it is a large unit whose light is not diffused. The introduction of the tungsten lamp has made available a long-lived and highly efficient light source, which has a good color value and can be secured in a large variety of sizes. Its high efficiency permits the use of proper screens for diffusing its light and reflectors for directing the light from less to more desirable directions. This means that the lamps may be placed low enough to avoid interference with foliage, which is highly desirable in residence districts. Tungsten lamps were first used in street lighting in place of series carbon incandescent lamps; they proved so successful that they soon replaced practically all these lamps and a great many gas lamps. They are also used on multiple systems, particularly in the decorative lighting of prominent business streets. Series tungsten lamps are operated on either the "adjusted socket" or the "regulator" systems. In the former a small resistance is mounted in each street hood in parallel with the lamp and operates to maintain the circuit continuous and at its normal current value in case of lamp burnout or removal. In the regulator system the series of lamps is supplied from a constant current regulating transformer; each lamp is shunted by an insulating film cut-out to maintain the continuity of the circuit in case of burn-out. The ordinary constant-current regulator is designed for use on arc-lamp systems, where it works very well; on series tungsten circuits a closer regulation is needed and this is obtainable with a new design of constant-current transformer built by the company with which Mr. Stephens is connected; it maintains the current within one per cent of normal value, regardless of the number of lamps burning on the circuit. The author concluded his paper with a plea for the education of the public to a realization that the flaring appearance of a street lamp should not be regarded as a measure of its excellence, and finally that the raising of the standard of street illumination in our cities will produce superior results that will justly compensate for the increased cost.

Chas. F. Scott, with a number of others, made interesting comments.

"The Attitude of the Central Station Manager towards Illuminating Engineering," by Roscoe Scott, was next read and discussed.

ATTITUDE OF CENTRAL-STATION MANAGER TOWARDS ILLUMINATING ENGINEERING.

The manager of a small station should attack his lighting problems in accordance with the same principles that are recognized by the expert illuminating engineer. In planning a lighting installation six questions present themselves, as follows: Is the illumination of the proper intensity? Is the light sufficiently diffused? Is the light properly distributed? Is the light of the proper quality? Is the light economically produced? Is the installation satisfactory from an artistic point of view? The lighting must be satisfactory from each of

these respects and the author explains in general what the requirements are in each particular. He then shows that it is necessary to keep in line with the progress in illuminating engineering and no better way presents itself than by membership in the Illuminating Engineering Society, whose transactions contain the most valuable information on illumination available. The central-station manager should co-operate with the incandescent lamp manufacturers who can furnish him with a mass of detailed information regarding the characteristics of standard lamps and reflectors. Considering the different voltages, efficiencies, styles and types, there are at least 2,500 distinct kinds of incandescent lamps manufactured by the members of the National Electric Lamp Association. These lamps are far superior to the foreign makes of incandescent lamps that are shipped to this country. In conclusion the manager who sees to it that the lighting installations on his circuits are correctly designed will find that his complaint department has very little to do and the satisfaction of his consumers with his sale of illumination and not merely current will quickly show itself in the amount of new business obtained.

Convention Notes.

The Nernst Lamp Company, Canadian Department, was the only company which ventured an exhibit at the Convention. A. E. Fleming, Canadian manager, was in charge and showed a wide assortment of the newest Nernst lamp fixtures.

The Northern Electric and Manufacturing Company distributed a self-registering B. & S. wire gauge to the delegates.

The Canadian Tungsten Lamp Company, Limited, Hamilton, Ontario, during the convention distributed germproof glass telephone mouthpieces.

Railroad Commission of Wisconsin News.

The statistics for electric utilities operating in Wisconsin for the year ending June 30, 1909, show the following general results:

"Twenty-six companies reported on Class A forms which covers companies operating in cities of 10,000 population or over.

Class A Companies:	
Total operating revenues	$2,646,039.47
Total operating expenses	1,645,636.05
Net operating revenues	$1,000,403.42
Non-operating revenues	147,348.22
Gross income	$1,147,751.61
Dividends paid	309,541.67

"One hundred and forty-eight companies reported from cities of less than 10,000 population, and the following figures show the totals for the year for these companies:

Total operating revenues	$1,035,570.21
Total operating expenses	837,576.26
Net operating revenues	197,993.95
Non-operating revenues	51,640.78
Gross income	$ 249,534.73
Dividends paid	25,149.56

"The total earnings of all electric utilities reported corrected for refunds, etc., was $3,681,609.68.

This amount was divided about as follows:

Commercial lighting earnings	$2,172,291.38
Municipal contract lighting earnings	594,305.30
Commercial power earnings	521,079.01
Municipal power earnings	30,712.58
Sales to other utilities	238,148.93
Miscellaneous earnings from operation.	125,965.79

"The balance sheets of all the companies reporting shows the total cost at the first of the year of electric plants in the state as $23,257,278.21.

The following table shows the electric equipment data as reported by all the companies:

Total commercial consumers	59,463
Arcs	8,829
Motors:	
Number	9,890
Total horsepower	34,984
Total connected lead in kilowatts	92,093
Meters	51,758
Transformers	6,819
Boilers:	
Number	352
Total horsepower	66,757
Waterwheels:	
Number	146
Total horsepower	38,410
Steam engines:	
Number	265
Total horsepower	94,262
Gas engines:	
Number	21
Total horsepower	1,940
Total prime motive power-rated horsepower	134,612
Electric generators:	
Number	460
Total kilowatt capacity	74,269

Of the 174 plants reporting about fifty, or thirty per cent, are municipal plants. About seventy-five plants give continuous service throughout the twenty-four hours.

Electric Equipments for Pullman Cars.

An improved system of electric lighting is to be installed on the new steel cars which are being built by the Pullman Company for use on the Twentieth Century Limited. In addition to the new lighting equipment there is also to be a complete system of exhaust fans for keeping the air fresh in the cars.

A COMPARISON OF MAGNETIC PERMEAMETERS.

BY CHARLES W. BURROWS.

Measurements of magnetic properties of materials are usually made on specimens in the form of comparatively short straight bars. This form is chosen because it is easily machined and readily inserted in fixed magnetizing coils. Neither of these conditions are met in the case of the ring specimen, although such a form is more desirable from purely magnetic considerations. For the testing of straight bars there are available several commercial instruments, besides a number of more strictly laboratory methods. Each piece of apparatus has its champions who sometimes make extravagant claims and seldom, if ever, are willing to admit that an error as great as five per cent exists in their particular type of apparatus.

In order to determine what agreement exists between magnetic data determined by different experimenters working with different apparatus, an investigation, of which this may be considered a preliminary report, has been undertaken. The method has been to measure in each apparatus the same specimen; or, if this is not feasible, specimens of as nearly as possible the same magnetic properties. This has been done with three different grades of material, a good quality of soft Norway iron, a medium quality of cold-rolled Bessemer steel, and annealed high-carbon tool steel.

Fig. 1 gives the normal induction data for these materials as well as for one sample each of nickel, silicon-steel and commercially pure Ingot iron. From these curves one may get a general idea of the distinguishing features of the metals studied.

These six rods were carefully measured by the author's compensated double yoke method, and also by a certain permeameter. In Fig. 2 are plotted the corrections to be applied to values determined by the same permeameter to bring those results into accord with my own.

These shearing curves show a characteristic course. For low and moderate inductions the correction is negative, that is, the permeameter indicates a magnetizing force in excess of its true value. For the softer mate-

rials, iron, Bessemer, and silicon-steel, this initial correction is nearly proportional to the induction. As the upper inductions are reached, the shearing curve bends over toward the axis and passes through a point of zero correction. Beyond this point it changes sign and increases very rapidly. If this upper part of the shearing curve is plotted against H instead of B it appears that in this region the correction approaches proportionality to H. This is also evident from the fact that in this region the shearing curves for the different materials lie relatively to each other in the order of the permeability.

In discussing results of this kind, one is at a loss how to proceed. We may consider the correction to be applied to H to reduce the observed value to the true value for a given fixed induction or we may consider the correction to be applied to B to reduce the observed value to the true value for a given magnetizing field; or, lastly, we may employ a combination of the two. In discussing the results in this paper, I shall assume that the induction is fixed and consider variations between true and observed values of the magnetizing field for each particular induction.

This is justified for two reasons. In the first place, the total induction across any section of a bar is a calculable function of the electromotive force induced in a small test coil closely surrounding the rod, and hence the induction may be known exactly. On the other hand the magnetizing force depends not only on the current and winding of the magnetizing coil, but also in a complicated way upon all joints, gaps and non-uniformities in the magnetic circuit. In the second place, most calculations of the magnetic portions of electrical machinery start with the assumption of a given flux density, and calculate the current-turns necessary to produce this flux. One must be warned, however, that as the lower inductions are produced by relatively small magnetizing fields, a small variation in the absolute value of this magnetizing field may appear as a large percentage difference.

Figures similar to Fig. 2 might be given for other forms of permeameter to show how the shearing curve depends on the instrument as well as the nature of the test specimen. This has been done for the three materials, Norway iron, Bessemer steel and annealed tool steel. It is not necessary, however, to present all the data, as a satisfactory comparison can be made by considering the shearing corrections for a single quality as tested in various permeameters.

Fig. 3 gives the shearing curves showing the corrections to be applied to the data of different apparatus when testing a given quality of Norway iron. The same identical specimen was not measured by each permeameter, but specimens from as nearly as possible the same stock were measured by an apparatus, and also by the author's compensated double yoke method. The results are thus all connected by the data of this latter method, which for the purpose of comparison we assumed as normal. The curves for an ellipsoid of dimensional ratio 100 are calculated from the theoretical value of the demagnetizing factor and the experimental data of the Norway iron of Fig. 1.

One can get a better understanding of these shearing curves if he consider for a moment the individual corrections that are liable to enter into a magnetic measurement. Fig. 4 shows in conventional form a magnetic circuit consisting of the test specimen T and a yoke Y connecting the ends of the specimen. With modification of details this is the magnetic circuit of all types of permeameter. The magnetomotive force is applied through the solenoid M and the induction is measured by a test coil C surrounding the specimen, or by some other suitable device placed in or near an opening in some part of the magnetic circuit. Whatever the individual arrangement may be, the corresponding corrections are modified in magnitude rather than in nature.

The greatest difficulty encountered is in the measurement of the field over the section whose induction is to be determined. At this section, A in Fig. 4, the field has at least two components, that due to the current in the solenoid and that due to the poles formed at the ends of the specimen where it joins the yoke. A third component is traceable to the fact that the yokes themselves are acted upon by the field of the solenoid. The field due to the poles at the end of the specimen is opposite to that of the solenoid so that the true field is less than that indicated by the current in the solenoid. The magnitude of this correction can be calculated for a specimen in the form of an elongated ellipsoid without yokes. Curve a, of Fig. 4, gives the correction curve for such an ellipsoid having a dimensional ratio of 100. The field due to magnetization of the yokes by the solenoid is in the same direction as that of the solenoid. This correction will be proportional to the product of the current in the solenoid and the permeability of the yokes. As, however, the field in the region affected is comparatively small, and the permeability is small and slowly increasing, this correction

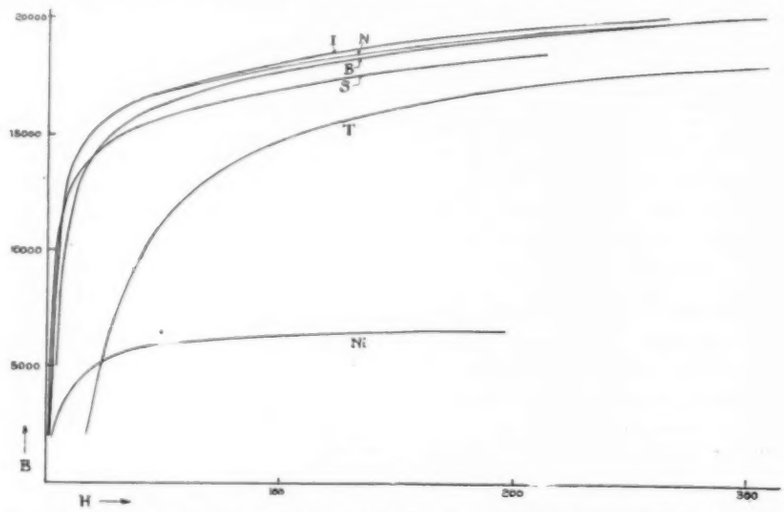


FIG. 1.—NORMAL INDUCTION DATA FOR COMMERCIALLY PURE INGOT IRON (I), NORWAY IRON (N), BESSEMER STEEL (B), SILICON STEEL (S), TOOL STEEL (T), AND COMMERCIAL NICKEL (Ni).

will be nearly proportional to the current. The exact magnitude of this correction (curve b) is difficult to calculate even approximately.

A correction to the observed induction is frequently necessary, due to the fact that the test coil, or the corresponding indicator, encloses some magnetic flux which does not pass through

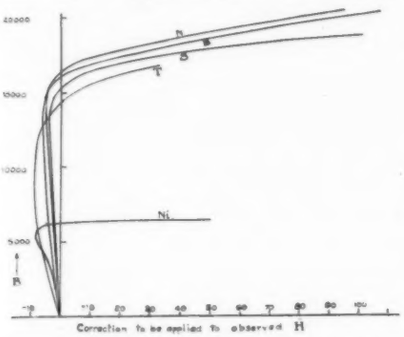


FIG. 2.—APPROXIMATE CORRECTIONS TO BE APPLIED TO THE DATA FOR THE MATERIAL OF FIG. 1, AS OBTAINED FROM A CERTAIIN PERMEAMETER.

the specimens. Suppose, for instance, that the area of the test coil is four times that of the specimen. Since the field in the space immediately surrounding the rod is H, the test coil indicates an induction of $B + 3H$. This is insignificant for low intensities, but becomes appreciable at the higher values. The corresponding

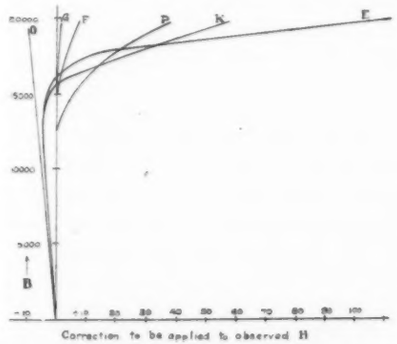


FIG. 3.—SHEARING CURVES FOR A GIVEN QUALITY OF NORWAY IRON, AS DETERMINED BY VARIOUS APPARATUS.—E, ESTERLINE; P, PICOU; K, KOEPSEL. G AND F ARE FROM FOREIGN RESEARCH LABORATORIES; O IS A THEORETICAL ELLIPSOID OF 100 DIAMETERS.

correction to the magnetizing force in this case is easily seen to be $3H$ multiplied by the derivative of H with respect to B. This derivative depends upon the nature of the specimen. Curve b of Fig. 4 shows this correction curve for a particular bar of Norway iron. Curve R of the same figure is the resultant of curves a and b, and shows a remarkable resemblance to the experimental curves of Fig. 2. In this resultant curve the lower portion is determined almost entirely by the demagnetizing action of the ends of the bar, while the upper portion is most influenced by the excess of flux measured by the test coil.

The shearing curves for the apparatus E and K (Fig. 3) are seen to be approximately equivalent to that given by an ellipsoid of 100 diameters when the induction is measured by a relatively large test coil. The Picou correction seems to indicate an additional error proportional to H. This is quite probable, as with the short test piece used in this apparatus and the method of compensation of yoke reluctance it seems that the effective length assumed is too large. Such an assumption would account for over half of the measured shearing corrections.

Owing to the complex nature of the shearing correction, it is impossible to make a single fixed compensating device counteract the error at all flux densities.

The Koepsel apparatus used for curves K attempts to compensate for the field due to the action of the solenoid on the yokes by adding in series with the main coil a few turns about the yokes which oppose the main magnetomotive force. This accounts for the peculiar shape of the shearing curve at high flux densities.

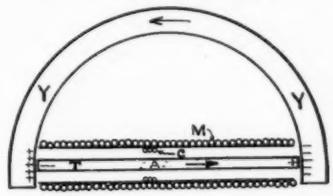
For the Esterline apparatus data were obtained from four laboratories, and curve E represents the extreme values in the shearing curves. Here an attempt is made to compensate for each source of error separately. The wide divergence between the extremes seems to indicate that this adjustment is a matter of some uncertainty.

The curves G and F of Fig. 3, which were obtained from certificates of two foreign research laboratories, and the curve P after the application of certain calculable corrections show extreme variations of five per cent at an induction of 20,000 gausses. This may be considered as a first approximation to the agreement that is attained by well equipped laboratories. Direct reading commercial instruments may be in error by as much as 100 per cent of the true value.

In spite of the great differences which different methods give, it is encouraging to note that any one method applied consistently and carefully can be made to give results consistent to a few per cent. Consequently, by means of calibrated standard rods the correction curves can be drawn and the indications of one apparatus expressed in terms of a second to five per cent.

International Exposition of the Applications of Electricity to Railroads in St. Petersburg.

In view of the importance of electric traction and of the advantages of "white coal," of which Russia has large reserves, the Russian Imperial Technical Society is organizing an in-



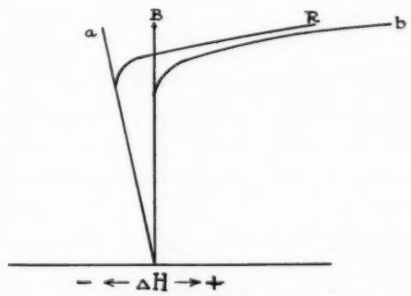


FIG. 4.—A CONVENTIONAL MAGNETIC CIRCUIT AND TWO COMPONENTS AND RESULTANT OF AN IDEAL SHEARING CURVE.

ternational exhibition of the applications of electricity to railroads to be held in August of this year. The exposition will be held under the auspices of the Imperial Government and its object is to bring to the knowledge of the public all the latest inventions and improvements in electric traction. The organizing committee is headed by His Excellency N. D. Sytenko, who requests all those occupied in any way with the application of electricity to electric traction to make an effort to participate, for Russia is about to electrify a large part of its railroads. A standard gauge track will be constructed in the exposition grounds for the practical demonstration of electric locomotives and motor cars. Any desired information may be obtained at the Bureau of the Exposition, Panteleimonska 2, St. Petersburg, Russia.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

BINDERS FOR COAL BRIQUETS.

BY C. L. HUBBARD.

A recent bulletin issued by the United States Geological Survey gives some valuable data relating to tests made at its St. Louis fuel-testing plant regarding the best material for binders in the manufacture of coal briquets.

A summary of the more important results and recommendations is given below. Coal in the process of mining and transportation, and on exposure to the weather, is subject to more or less disintegration. This disintegrated coal is called "slack" and often amounts to a considerable percentage of the lump coal produced in the mines. If this slack is wasted the loss ranges from five to fifty per cent, or even more, of the total coal mined. It is therefore evident that the utilization of this waste becomes an important economic consideration.

Coals which are suitable for the production of coke present no difficulties in this direction, as the slack may also be used for this purpose as well as the lump coal. Again, in the case of coal which cakes quite readily, the slack may be used for boiler purposes, as it fuses together more or less quickly, and burns on the furnace grate without great loss.

In other cases the full value of the slack can only be obtained by first forming the coal into briquets, which, when of good quality, are equal to, or of greater value than, the original lump coal from which the slack was derived.

The problem is not always how to make briquets of the best possible quality, but rather to produce at a profit a briquet of satisfactory grade for the use intended.

Among the characteristics of good briquets which should be considered may be mentioned—coherence, hardness and toughness, density, size and shape, weathering, absorption, and burning qualities.

Briquets of any degree of coherence can be made by varying the amount of binding material and the pressure. An increase in either of course adds to the cost of manufacture.

Ordinarily briquets may be considered sufficiently coherent when the loss occasioned by dust and breakage in handling does not exceed five per cent. The briquet should be sufficiently hard, but not hard enough to be brittle. A briquet can be made harder by using a binder with a higher melting point. The requirement of the French Admiralty is that they shall not soften at sixty degrees centigrade. Ordinarily it is sufficient that the briquet shall not soften on the hottest day and shall behave satisfactorily on burning.

The density of the briquet should be made about the same as that of the lump coal from which the slack is derived. The density is increased by pressure.

The matter of shape and size is of importance. Heavy rectangular blocks allow a large output for the investment and are consequently cheaper to manufacture and convenient for storage. On the other hand, they have the disadvantage of large smooth surfaces and are usually broken up before feeding into the furnaces. Prismatic shapes with rounded edges are most popular abroad. Either these or ovoid shapes of less than two pounds weight are preferred for domestic use. The rounded edges cause much less dust and breakage in handling and insure a good air circulation and thorough combustion, but are wasteful in space and make the briquet somewhat harder to ignite.

The briquets should be able to stand long exposure to the weather with but little deterioration. In the process of manufacture they are liable to crack if they lack the proper proportion of binder or have been improperly mixed or have not been pressed sufficiently hard. Cracks, however produced, permit the entrance of moisture and cause a rapid deterioration of the briquet on exposure to the weather. Lignite briquets owing to their more porous structure and tendency to absorb water do not stand exposure to the weather so well as those made of other kinds of coal.

The binder used must be insoluble. The great obstacle to the use of starch, molasses, and sulphite-liquor residues as binders is their solubility. With pitches and tars, a slightly increased percentage of binder is necessary in briquets that are to stand long exposure to the weather.

The briquet should not absorb more than three per cent of moisture. The amount absorbed is increased when either the slack itself or the briquet is porous, or when the binder has a tendency to attract moisture. The ease with which a briquet will ignite depends largely upon the slack used and also upon the form and size, as already mentioned.

Briquets from fine slack ignite less readily than those in which a coarser grade is used. The use of an inorganic substance, such as clay or magnesia, as a binder or constituent of a binder, acts in a similar manner.

The briquet should burn with a clear, intense flame, and without odor or smoke. The burning of the briquet and the flame produced, as well as the amount of smoke given off, will depend largely upon the quality of the slack used and on the completeness of combustion, the same as for coal. So far as the binder is concerned, it should not be of a material which will volatilize before the temperature is sufficiently high to insure complete combustion of the gases formed. Inorganic binders produce no smoke. Organic binders, like starch, molasses, or sulphite-liquor residues, do not volatilize until decomposed, hence they give off

little or no smoke. Pitch, tar, petroleum residues, etc., when used as binders, volatilize during combustion, and will cause smoke and possibly odor if the gases formed are not completely burned. But it is easily possible to regulate the conditions so that less smoke will be produced when burning the briquets than when burning the lump coal or slack from which they are formed.

The quality of the briquet retaining its shape in the fire is very important and depends on the properties of both the coal and binder used. The binder must hold the coal particles together until they are sufficiently softened to cohere. The temperature at which different coals soften or cake together varies greatly. With a readily caking coal, a binder that volatilizes at a comparatively low temperature may be used. With coals that cake at a higher temperature, a less volatile binder must be used to secure satisfactory results.

As the inorganic binders add ash, and the other nonvolatile binders (starch, molasses, etc.) are not waterproof, it would generally seem better where commercially possible, to mix a coal that will not cake of itself with a sufficient quantity of caking coal. Then with a suitable binder the briquet will retain its coherence in the fire by the softening of the caking coal in the mixture.

The amount of ash left when the briquet is burned is the sum of that contained in the slack and in the binder used. Organic binders, as a rule, contain a smaller percentage of ash than the slack coal, and therefore slightly decrease the total percentage of ash in the briquet. When inorganic binders are used the ash thus added is a decided disadvantage.

Theoretically the heating value of a briquet is the sum of the heating values of the coal and of the binder, and it cannot possibly exceed this amount. Organic binders usually equal or exceed in heating value, weight for weight, the slack coal used. Briquets have the advantage over coal in that their burning is accompanied with less waste and they permit a better regulated and more complete combustion to take place. From this it is evident that the evaporation results should at least equal those of the best lump coal from the screenings and dust of which the briquet was made.

For detailed accounts of the tests made upon a large number of binders in connection with different grades of coal the reader is referred to Bulletin No. 343 of the United States Geological Survey.

The best binder to use in any particular case depends entirely on the locality, the character of the coal, and the purpose for which the briquets are intended.

For purposes of comparison some of the binders will be briefly considered which are available for coal which is fairly easy to briquet and which cakes rather readily. Some coals will briquet with somewhat less and others require greater percentages of binder, but an endeavor has been made in the following summary to strike a reasonable average.

The results of the various tests showed that in general, for plants situated where it can be obtained, the cheapest binder is the heavy residuum from petroleum. This is commonly known as asphalt. Four per cent of this binder is sufficient, at a cost ranging from forty-five to sixty cents per ton of briquets produced.

Second in order is water-gas tar pitch, five to six per cent usually proving sufficient, at a cost of fifty to sixty cents per ton of briquets. As water-gas pitch is also derived from petroleum, it will be available more particularly in oil-producing regions.

Third in order is coal-tar pitch. Being derived from coal, this material is widely available. From 6.5 to 8.0 per cent is usually required, at a cost ranging from sixty-five to ninety cents per ton of briquets produced.

In certain localities natural asphalts may be used and also tars derived from wood distillation. The price of these will vary greatly under different conditions, but there are undoubtedly places where they could easily compete with the binders mentioned above. Wax tailings can also be used to good advantage with coal which cakes easily. Pitch obtained from producer-gas tar makes an excellent binder, but is not yet on the market, but will probably be available for this purpose in the near future.

Briquets may also be made with a binder consisting of one per cent starch at a cost of about twenty cents per ton of briquets produced. These are excellent in quality except they are not waterproof, which of course is an important requirement in case of transportation.

The waste sulphite liquor from paper mills also produces excellent briquets, but like the above, they are not waterproof.

Of the inorganic binders, magnesia seems to be the most important. Its cost per ton of briquets will range from twenty-two to thirty cents. Other inorganic binders may easily compete in price but not with the quality of briquet produced.

Lignite coal does not briquet easily and offers a particularly difficult problem. In case it cakes readily, the best results are obtained with petroleum asphalt or water-gas tar pitch, using a larger percentage than for ordinary coals. For lignites which do not cake, starch, sulphite liquor, and magnesia may be used.

Lignites may also be briqueted without a binder if burned on a special grate so constructed as to overcome the tendency of the coal to fall to pieces in the fire.

In regard to coal-tar pitch, asphalts, and petroleum residues generally, the following methods are suggested for determining their value for briqueting purposes and for preparing them for use:

The pitch or tar is distilled and all oils coming off below 270 degrees centigrade are rejected as being of no value. The flowing point of the portion to be used for briqueting is then determined, and should not in general be less than seventy degrees centigrade. The pitch is extracted with carbon disulphide.

The smaller the amount of residual carbon the more satisfactory will be the pitch, and the less readily the coal cakes the higher must be the flowing point of the pitch. If a pitch cracker is to be used the flowing point must be above 120 degrees centigrade to work successfully on a hot summer's day. In winter, pitch with a flowing point of 100 degrees centigrade may be used. All softer pitches and asphalts must be melted and mixed in liquid form with the coal. If the softening point of the pitch is above 150 degrees centigrade, it should either be thinned or superheated in the mixer.

The efficient use of a binder depends very largely on the proper regulation of the conditions in the mixer. If the

binder contains low-volatile compounds it increases the tendency of the briquet to soften and crack open before combustion, in order to liberate the gases formed. Such a condition naturally increases the amount of smoke produced and makes the briquet less desirable as a fuel.

The relation between the coal and the binder is purely physical. Chemical action, if any, is so slight as to be wholly negligible. The properties of the briquet are the properties of the coal plus those of the binder, and the combination of the two in briqueting does not materially change the properties of either. If the binder is brittle the briquet will be relatively brittle at the same temperature. The temperature at which the binder softens will be the same, whether by itself or in the briquet, so that if the coal softens at a high temperature the binder must melt at a relatively high temperature to give satisfactory results in the fire. If the coal does not cake at all, then the binder must not melt or be destroyed by the heat, if a perfectly coherent briquet at all temperatures is desired. Only inorganic binders could fulfill this condition, and their use is objectionable on account of the additional ash.

Organic binders that do not melt, such as starch, etc., give the best results in the fire with a noncaking coal, but are not waterproof, as already stated. If the binder is to any extent soluble in water the briquet will not withstand exposure to wet weather.

The binder will go into solution as surely, though more slowly, in the briquet, as when it exists in the pure condition, unless the briquet is in some way rendered waterproof.

Many experiments have been made along the line of waterproofing by immersion in oil. The experiments indicated that any oil would waterproof the briquet when externally applied, but asphalt tar, which was the thickest oil tested, gave the best results. It is doubtful if external waterproofing with a thick oil will ever be successful, owing to the cost and difficulty of manipulation, but a thin oil, such as crude petroleum, might answer. At any rate, laboratory tests with small briquets cannot finally decide the point, and experiments should be conducted on a larger scale.

It may not, perhaps, be a repetition to summarize here, in the approximate order of their importance, the desirable qualities of a binder, as follows:

(1) It must be sufficiently cheap to make the manufacture of briquets profitable.

(2) It must bind strongly, producing a briquet sufficiently hard, but not too brittle.

(3) It must hold the briquet together satisfactorily in the fire.

(4) It must produce a briquet sufficiently waterproof to stand the conditions of use.

(5) It should not cause smoke, or foul smelling, or corrosive gases, or foul the flues.

(6) It should not increase the percentage of ash or clinker.

(7) It should increase, or certainly not diminish, the heat units obtainable from a given weight of fuel.

The main problem in briqueting is to find a suitable binding material at a sufficiently low cost. When the difference in price between the slack coal and the first-class lump coal is $1.00, the cost of briqueting should not exceed this amount. Of this, the binder must cost less than sixty cents per ton, as the cost of manufacture averages about forty cents. To leave out of consideration the possible advantages in the use of briqueted coal, over run-of-mine coal, due to the greater efficiency and smokelessness of briquets, it will probably not be necessary to pay any attention to binding material costing $1.25 or more per ton of briquets produced.

Power Plant for Oregon Mining Camp.

A recent dispatch from Sumpter, Oregon, states that the Granite Lighting and Power Company, near Granite, is about to develop the power plant planned by it on the north fork of John Day River.

Rejects Municipal Ownership of Lighting Plant.

By a vote of ten to two, the city council of Burlington, N. J., has rejected a proposition for a municipally owned lighting plant and a short-term franchise for public-service corporations, and has awarded a fifty-year franchise to the syndicate which recently purchased the property of the Burlington Electric Light and Power Company. The new company agrees to erect a $100,000 plant in the city. It also agrees to light firehouses and the City Hall free of charge. The fifty-year franchise granted to the company is for a slight increase in the old rates for street lighting. The company also seeks a contract for operating the drainage plant and waterworks, claiming it can reduce the municipal expense of operation by twenty-five per cent.

Tarsus Lighted by Electricity.

The ancient city of Tarsus, in Asia Minor, has recently been lighted by electricity. In reporting this fact, Consul Edward I. Nathan, of Mersine, says the power is taken from the rapidly flowing Cydnus River. About one and one-half miles from the city an eighty-horsepower turbine is made to drive a large dynamo, which furnishes sufficient power for 1,000 lamps of sixteen candlepower each; 450 are now used to light the streets of the city and the remainder will be furnished to private consumers. It is proposed to extend the electric-lighting system to Adana and Mersine, the power to be likewise furnished by the Cydnus River and transmitted by wire to these places. The name of the concessionaire may be secured from the Bureau of Manufactures, Washington, D. C.

Cohoes to Use Electric Power.

It has been definitely decided that the power of the Cohoes Company is to be changed from water to electricity. A majority of the manufacturers who rely upon the Cohoes Company for motive power have signified their willingness to co-operate with the Cohoes Company in electrifying the power. The work of abolishing the hydraulic canals and establishing a power plant for the generation of electricity from the water-power will be begun within the next few months. T.

Water-tube Boilers for Power Station.

The new power station for the Richmond and Henrico Railway Company, Richmond, Va., will be equipped with forged steel water-tube boilers of Babcock and Wilcox make.

Weather Reports by Telephone.

Arrangements have been made by the United States Weather Bureau whereby all telephone subscribers in the State of Texas may be supplied with the weather reports free of charge by application to their central office.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THE MEASUREMENT OF SURFACE-BRIGHTNESS.

BY J. S. DOW.

It is rather interesting to observe how, as the study of illumination has been gradually developed, our methods of measurement have tended to approach closer and closer to realities, to take into account more perfectly the condition of affairs actually met with in practice.

One of earliest forms of photometry was the testing of illuminating gas. One examined and specified the quality of the gas supplied in terms of the candlepower of a standard burner passing a given amount of gas per hour and there the matter ended. Such measurements could, of course, take no account of the quality of the burners used in the rooms in which the gas was eventually burned by the householder nor of the manner in which he arranged his lights so as to illuminate the surroundings. They merely served to preserve a certain standard in the gas supplied.

Subsequently, when electric light came into use, the testing of individual lamps gradually became a more or less accepted process, but it was apparently not until about 1883 that Sir Wm. Preece first emphasised the need for measurements of illumination. In this early year he pointed out that it was the actual illumination of the surface that mattered. "We do not want so much to know the intensity of the light emitted by a lamp as the intensity of illumination of the surface of the book we are reading, or of the paper on which we are writing, or of the walls on which we hang our pictures, or of the surface of the streets and the busy pavements upon which the traffic of a city circulates."

Since that date we have become familiarized with the idea of measuring illumination and there are today many forms of apparatus intended for this purpose. It seems probable that in time to come the value of measurement in illuminating engineering, both as a means of preserving a record of the conditions, and as a means of driving home the truth of one's contentions, will be recognized even more fully. If one may hazard a suggestion as to the future of such instruments, it might be predicted that the tendency will be to aim more and more at simplicity and portability. What is needed is, above all, to make the measurement of illumination a thoroughly familiar and recognized process. Probably, just as in the case of electrical engineering, many different types of instruments, each having its respective field of action, will be developed and the distinction between apparatus of a purely scientific character, intended for use in the laboratory, and instruments for practical and commercial work will be better understood.

Yet even the measurement of illumination is, in a sense, only a step towards the ultimate end of photometric measurement. What really concerns us is, as a rule, not illumination but rather "surface-brightness"—what the Germans term "Flächenhelligkeit." By this is meant the actual brightness of the illuminated surface as it appears to the eye. Surface-brightness thus takes into account the coefficient of reflection of the material illuminated. The term is not in very general use at present but, under the title of "intrinsic brilliancy" it has been extensively applied to highly luminous surfaces, such as incandescent mantles, etc. Intrinsic brilliancy is, of course, one of the main factors in giving rise to a sensation of glare.

It therefore occurred to the author that a description of an instrument intended to measure surface-brightness, designed by himself and V. H. Mackinney and recently described by him at a meeting of the Illuminating Engineering Society in London,[1] might be of interest. But first a few examples may be mentioned of cases in which a knowledge of intrinsic surface-brightness would be useful. Take for example a school. The inspector can, of course, direct that the illumination on the children's desks is not to be less than a certain amount. Yet this is not enough. For it might happen that the child, owing to the shape of the desk, the position of the lights, or some other cause, would be obliged to hold his book at such an angle that the surface-brightness of the page was much below what the measure of the illumination would suggest. In the same way his head might fall in the way of the light when reading a book, although no shadow wire cast by the head of the inspector in using his photometer. Or, again, the paper used by the child might have a very inferior reflecting power which reduced the effective illumination to but a fraction of that which a test with an illuminometer might suggest. As a matter of fact the amount of light absorbed by many

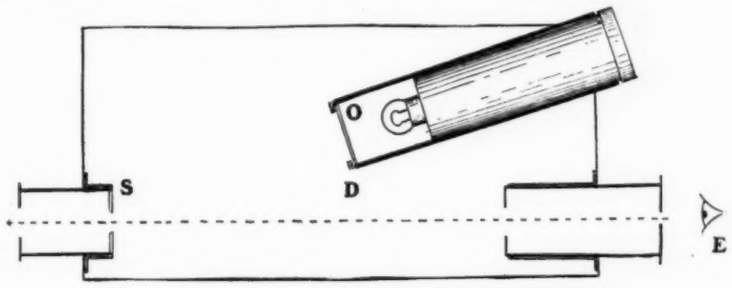


FIG. 1.—DOW-MACKINNEY PHOTOMETRIC INSTRUMENT.

1 See ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, June 25, 1910, page 1329. Also *The Illuminating Engineer*, London, June, 1910, pages 373-376.

newspapers printed on pink and green paper is very considerable.

What would be the most desirable test in such a case as this would be for the inspector to examine the brightness of the surface of the book exactly as the average child would use it and this can be done readily enough by means of an instrument designed to measure surface-brightness.

One important characteristic which such an instrument should possess would be portability. It should also be adapted for measuring the brightness of surfaces at some distance. For example it might often be desired to measure the brightness of an illuminated sign or diagram to which the observer could not get very close. An important respect in which such an instrument would differ from illumination photometers would be that there would no necessity for a tripod or level; it could and ought to be carried about like a camera under the observer's arm.

It is interesting to notice that an instrument of this class was described by Dr. C. H. Williams at a meeting of the Illuminating Engineering Society, in New York in 1907. Though differing in design from that about to be described, its aim seems to have been somewhat similar, and the photometer devised many years ago by Professor Weber, of Kiel, seems to have had the same object.

The instrument shown in the accompanying diagram, Fig. 1, was designed by the author in conjunction with V. H. Mackinney. The essential idea is to enable an observer to measure the surface-brightness of a surface by comparing it with a standard illuminated white one. The observer places his eye at E, looks directly at the illuminated surface S and sees through an aperture in this surface the object to be examined. The surface S is illuminated by an opal screen at O behind which is a small metallic-filament glow lamp. The illumination of the screen is altered by cutting off more or less of the light from the opal plate. The arrangement of the shutters which accomplish this is somewhat interesting, and will be understood from Fig. 2.

It was considered particularly desirable to secure a uniform scale, having equal divisions corresponding to a given change of illumination at any point. This was done by means of the sector-device shown in the figure. Two opaque screens A and B can pass in front of the illuminated sector S. The first of these, A, has a ring cut out, the area of this ring being exactly one-tenth of that of the whole sector. Hence as A is moved across the exposed area (and therefore also the illumination) is varied from 1.0 to 0.1 and the pointer attached to A moves on a scale having nine equal divisions corresponding to this range.

The lever A having been drawn across we can next reduce the illumination still further by bringing over the lever attached to B. This exactly resembles A except that it has no ring cut out. By bringing this lever across we gradually obscure the illuminated ring R and reduce the illumination at a uniform rate from 0.1 to zero. Naturally it would be possible to obtain a more extended range by adding several more shutters with rings of gradually diminishing area. But the arrangement explained above will probably answer all practical requirements.

In actually using the instrument one proceeds as follows: The glow lamp is lighted from a small accumulator,

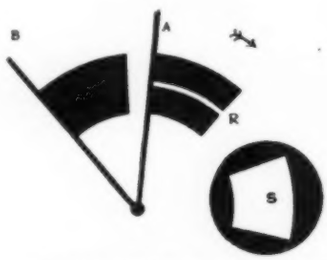


FIG. 2.—ARRANGEMENT OF SHUTTERS.

which can be either attached to the instrument or carried in the pocket. One then adjusts the distance of this lamp from the opal plate until the illumination of the surface S is, say, exactly one foot-candle. This is judged by comparison with a mat white surface placed at the requisite distance from a standard lamp and observed through the aperture. The lamp is then clamped in position and we know that the reading on the scale is in foot-candles.

At this point it may be neecssary to say a few words regarding the units in which surface-brightness is measured. There are two distinct methods of specifying this quantity. In the case of actual radiating surfaces, and when specifying the intrinsic brilliancy of illuminants, it is customary to express the results in terms of candles per square centimeter. But in the case of illuminated surfaces it appears to be usual to express the surface-brightness in terms of the illumination in lux or foot-candles; by this is meant the iling that on examination the surface would have to receive in order to have an equivalent brightness. Thus in stating that on examination the surface brightness of an area was so many foot-candles we merely mean that a pure white mat surface, when illuminated with this number of foot-candles, would possess the same apparent brightness as the area examined.

It is anticipated that the range of the instrument will be increased by the use of standard dark glasses, inserted in the path of the rays from the surface studied, thus cutting off exactly one-tenth or one-hundredth of the light. It is, of course, very convenient to have an equally divided scale, as the law of this instrument, if strictly carried out, should enable us to do. There are a number of small points which require careful attention in order that this may be the case, but Mr. Mackinney and the author anticipate that quite sufficient accuracy can be secured by careful design. Another matter that deserves consideration is the possibility that the results might differ at various distances from the surface examined. As far as experiments have been carried at present there seems little reason to expect any material difference for distances under five feet, but in any case it seems possible that any difference of this kind could be regarded a necessary consequence of the changed physiological conditions and, in short, as one which the instrument, measuring as it does the apparent surface-brightness, as it appears to the eye, ought to take note of.

There are a number of uses to which such an instrument could be put. The method of use is very simple as one merely points the apparatus at the surface to be examined; the whole arrangement can be carried about like a camera into any building in which it is desired to take measurements. One advantage of the instrument is that it should be possible to observe the brightness of a surface at a distance. For example one can determine the brightness of the goods in shop windows from the outside or of the contents of glass cases in museums and, in fact, obtain results without necessarily placing the instrument at the spot where the measure-

ments are to be made. Again one can easily apply the instrument to examine the conditions inside a recess or box which can certainly not easily be done by means of an illumination photometer.

As explained above the instrument is intended mainly for the measurement of surface-brightness. It could, however, equally well be applied to measurements of intensity of illumination by the use of a standard white surface which is placed in position on the wall, desk or other object which we wish to examine. The surface-brightness of a surface having standard properties as regards reflecting power, such a surface as pressed magnesia or white blotting paper for example, can be regarded as the illumination. When therefore one desires to measure the horizontal illumination on a table or the vertical illumination on a bookshelf one would merely place the standard mat white surface in position thereon and observe its brightness. In this way one can obtain many measurements of illumination which it would be literally impossible to take if one was compelled to place the instrument in the exact spot where the measurement is to be made. It will be granted, for example, that it is not a very easy matter to obtain the vertical illumination on a book shelf with most of the ordinary types of illuminometers. Again when one comes to consider the illumination of workshops one must be struck by the fact that a knowledge of the mean horizontal illumination, though useful, does not tell what we really wish to know in many cases. As a rule we are concerned with the illumination on the work and this may mean the illumination in a number of planes at various inclinations to the horizontal. But by merely placing the small standard surface at any part of a machine and studying its brightness we can at once learn all we want to know.

Another class of measurements in which a knowledge of surface-brightness is very essential is that connected with the examination of the intrinsic brilliancy and glare of modern illuminants. The impression of glare received by the eye in looking straight at a very bright source is believed to be chiefly due to its high intrinsic brilliancy. There has recently been some discussion as to the best method of measuring the intrinsic brilliancy of illuminants. The chief difficulty in applying an instrument of the kind described in this article to this problem is that the brightness of an incandescent source of light is so enormously greater than that of the illuminated surfaces one meets with in practice. It would therefore be necessary to employ very dark glasses or some analogous method of dimming the light. It is, however, possible that the instrument might be modified so as to yield a rapid and approximate measurement of the intrinsic brilliancy of shades and reflectors. Dr. L. Bell, Prof. L. Weber, of Kiel, and other authorities have suggested that the intrinsic brilliancy of a surface exposed to the eye in interiors should not exceed about two and one-half candles per square inch, and it should not be difficult to contrive a ready method of judging whether this value is exceeded or not. When exact scientific results are wanted, however, more deliberate methods of measurement would probably have to be adopted. One might, for example, ascertain the candlepower of the lamp in a given direction and then, by projection, also determine the area from which this light is received.

Instruments for measuring surface-brightness might, however, be applied more easily to examine the contrast in an illuminated interior. Professor Weber has pointed out that it is not enough to specify that an illuminant should not possess more than a certain intrinsic brilliancy. Its contrast with the surroundings should also not be too great, should not, he suggests, exceed 100 to 1. It seems possible, therefore, that instruments designed to measure surface-brightness might be profitably used first to measure the intrinsic brilliancy of the source and subsequently that of its surroundings.

It seems, therefore, that there are many cases in which a knowledge of the surface-brightness is what is really demanded and it would seem natural to specify that for certain purposes, reading for example, the paper should have a certain surface-brightness. This is really what is implied when we say that the illumination for reading should be three foot-candles, etc. In the same way it might be possible to come to an agreement that the walls of a library and other dwelling rooms should have a certain surface brightness since by complying with such a specification both the illumination provided and the reflecting power of the walls are taken into account. It may, therefore, be suggested that instruments designed to measure this quantity will have a wider application in the future than in the past. The demands of measurements in illuminating engineering and photometry are so exacting that there is certainly room for many different types of instruments, including the two conventional types at present mainly employed —photometers and illuminometers.

Special Illumination of Mexico City.

The government committee in charge of the plans for celebrating the centennial of Mexico's independence in September has arranged for a most brilliant illumination of Mexico City on the nights of September 15 and 16. Preparations are being made by the Mexico Light and Power Company to install 100,000 special electric lights for use on those two nights. These lights will cover the great Catholic Cathedral, the National Palace and the federal and municipal buildings. The lamps will range from eight to sixteen candlepower and will be varicolored. Decorative artists will transform the exteriors of the different buildings into a blaze of light and make the event a notable one from an electrical illuminating standpoint. The night of September 15 is of double significance, as it will mark the celebration of the eightieth anniversary of the birth of President Porfirio Diaz in addition to being the evening preceding the declaration of Mexico's independence. In all of the larger cities of Mexico and many of the towns of lesser importance preparations are being made for magnificent electrical illuminations of the public buildings during the centennial month. D.

Cheaper to Wire During Building.

The work of installing a new wiring system in the Brooklyn (N.Y.) federal building was begun a few days ago and calls for an expenditure by the government of $19,600. This improvement will take ninety days to complete.

It is stated that when the building was built wiring was offered for $2,000. This figure was thought to have been impossible by the officials in the building. That the cost would not have been over one-fourth as great, however, if the wiring had been put in at the start is conceded.

USE OF FLAMING ARCS FOR A LARGE ARENA.

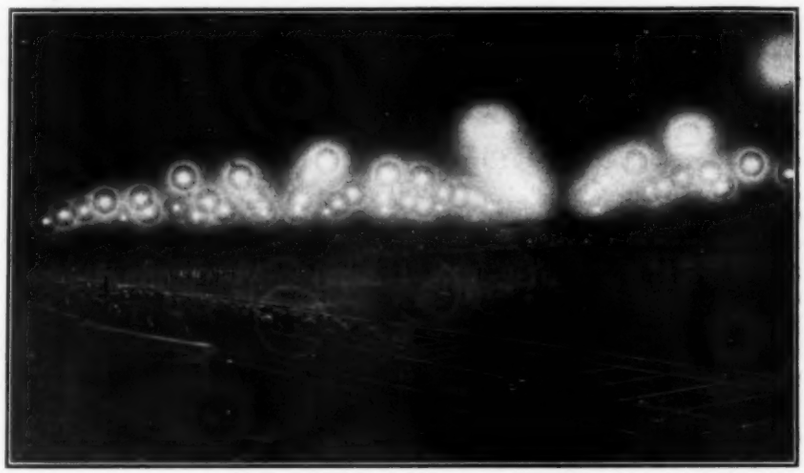
ILLUMINATION OF THE ARMY TOURNAMENT, GRANT PARK, CHICAGO.

In the extension of Grant Park on Chicago's lake front there is being held at this writing a great tournament by several regiments of the United States Army. The tournament was opened on July 4 in furtherance of the "Sane Fourth" movement and is scheduled to close on the evening of July 14. In order that as large an audience as possible could witness the drills and maneuvers of the soldiers an arena 400 by 600 feet in dimensions was cleared and surrounded by tiers of seats on all four sides, most of which were open to the public to see the exhibitions at leisure, arrangements were made to illuminate the arena in the evening and to give both afternoon and evening exhibition drills on the ten days of the tournament. On some of these occasions as many as 60,000 people witnessed the spectacle.

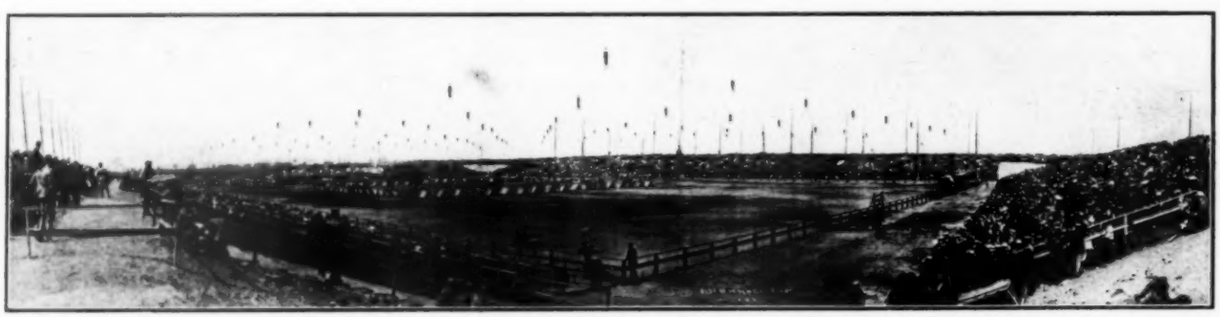
The problem of lighting the arena was solved by the use of flaming arc lamps on a scale greater than ever attempted before. Through the Chicago office of the Chas. L. Kiewert Company, eighty Aurola flaming arc lamps were secured. These were suspended at a height of thirty-five feet above ground in ten rows of eight lamps each, from steel messenger cables having a clear span of about 600 feet. The messenger cables were supported between fifty-foot poles set beyond the outer long tiers of seats and guyed to the ground. Each lamp was supplied with ten amperes and fifty-five volts, two lamps being in series on each side of a three-wire alternating-current system having 220 volts between the outers. Two step-down transformers located at the middle points of the long sides of the arena supplied the current to the three-wire network over the arena, forty flaming arcs being supplied from each transformer.

As each lamp was moderately rated at 3,000 candlepower, there was a total of 240,000 candlepower developed over the 240,000 square feet of the arena. The resulting illumination was more than adequate to show every detail of the maneuvers of the troops. The light distribution was very uniform over the entire arena. The golden yellow quality of the light was found to harmonize well with the khaki uniforms of the soldiers. On the whole the brilliant lighting feature alone elicited as much comment as any feature of the exhibition by the troops. The accompanying night view shows only a portion of the arena.

The entire lighting system was installed by the Commonwealth Edison Company inside of three days at a cost of about $5,000. This company also supplied the current for the flaming arc currents and for fifty inclosed arc lamps that were used to illuminate Camp Dickinson, where the soldiers were encamped north of the arena. The trimming of the flaming arcs over the arena was accomplished by means of a tower wagon with a high extension ladder at its top.



NIGHT VIEW OF ARMY TOURNAMENT AT CHICAGO.



PANORAMIC DAY VIEW OF THE ARMY TOURNAMENT AT CHICAGO.

Cincinnati Inadequately Lighted.

The Business Men's Club of Cincinnati recently presented a courteous communication to the city council calling attention to the inadequate lighting of the downtown district of the city. This has elicited unfavorable criticism from many visitors who have been surprised at the gloom of the principal business streets. The club has therefore respectfully urged that the subject be investigated at once to the end that Cincinnati's business district be made attractive by night in keeping with its importance.

The laying of the new cable between Nagasaki, Japan, and Tamsui, Formosa, to cost $568,000, will be begun at once by the Japanese Government.

TELEGRAPHY—TELEPHONY, and WIRELESS.

Telephones in the Zion City Lace Factory.

For the textile mill or factory, interior telephone systems are often used to eliminate confusion and waste of time. The accompanying illustrations are views taken of the "Inter-phone" system in the lace factory of Marshall Field & Company, at Zion City, Ill. They furnish a good example of the usefulness of this sort of communication to a busy textile plant.

The "Inter-phone" system in this establishment performs instantly the duties which formerly called for the employment of messengers, the loss of much time, and a great deal of expense without any attending results that were satisfactory.

It is a conceded fact that where organization and system are desired in any kind of a business establishment an adequate means of intercommunication is an essential. The telephone, which is everywhere the chief agent of instantanous communication, finds in a factory of this sort one of its greatest fields of usefulness.

The manager of the plant at Zion City keeps in touch with all of his subordinates and departments by means of a desk set, by the side of which is mounted a key-box containing the buttons and labels through which intercommunication is secured.

Fig. 1 shows a view in the cutting room of the Zion City factory, where the "Inter-phone" set—which in this instance is a one-piece instrument—is mounted by the side of the desk. Here the connecting buttons are in the same case with the receiver hook and transmitter, and connection with the rest of the system is obtained by merely pressing any one of the connecting buttons.

Fig. 2 shows an "Inter-phone" set in the shipping room placed conveniently near a writing shelf and through the medium of which orders and other communications of importance in this business are transmitted daily.

As is well known, this system of communication is automatic, requiring neither switchboard nor operator. The system at the Zion City plant consists of ten stations. Instruments have been placed conveniently for the use of the cutters, factory assistants, the forewoman in charge of finishing the lace products and the officials of the factory.

The statement is made by the people in charge that this system has been working to great satisfaction since it was installed. The "Inter-phone" sets were made and installed by the Western Electric Company.

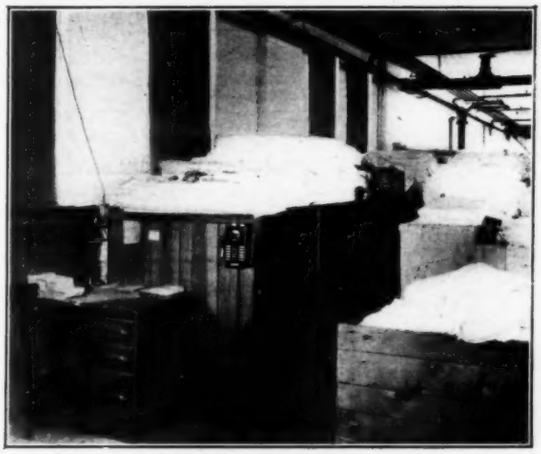


FIG. 1. INTER-PHONE IN CUTTING ROOM, ZION CITY LACE FACTORY.

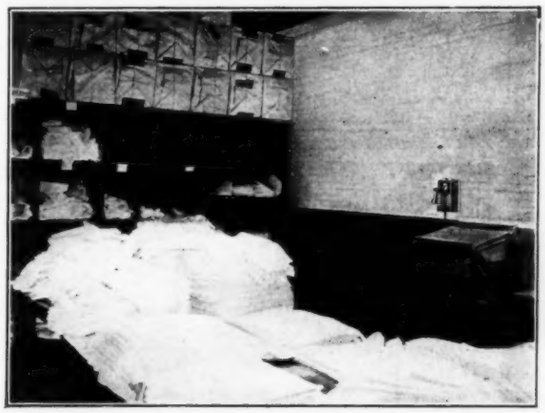


FIG. 2. INTER-PHONE IN SHIPPING ROOM, ZION CITY LACE FACTORY.

Telegraph Record Made at Reno.

Owing to the press of telegraph business connected with the recent fight at Reno, Nev., both the Western Union and the Postal Telegraph Company broke all previous records for a single day's work.

More than 800,000 words were sent at an average cost of two cents a word. The space given by seven New York newspapers was 121 columns, and it is estimated that papers in that city alone paid $6,000 in telegraph tolls.

Ouster Suit Brought in Kansas.

An ouster suit against the Missouri and Kansas Telephone Company and the American Telephone and Telegraph Company has been filed at Topeka, Kan., by Attorney-General Jackson of that state, based on the purchase of the Wichita and Hutchinson independent systems last winter. The court issued a temporary injunction to prevent either company from acquiring more independent lines until the case is settled.

The History of the Telephone.

The Telephone and the Telephone System—II.

BY HERBERT N. CASSON.

The next problem that faced the young men of the telephone, as soon as they had escaped from the clamor of the Mysterious Noises, was the necessity of putting the wires underground. At first, they had strung the wires on poles and roof-tops. They had done this, not because it was cheap, but because it was the only possible way, so far as anyone knew in that kindergarten period. A telephone wire required the daintiest of handling. To bury it was to smother it, to make it dull or perhaps entirely useless. But now that the number of wires had swollen from hundreds to thousands, the overhead method had been outgrown. Some streets in the larger cities had become black with wires. Poles had risen to fifty feet in height, then sixty—seventy—eighty. Finally the highest of all pole lines was built along West Street, New York—every pole a towering Norway Pine, with its top ninety feet above the roadway, and carrying thirty cross-arms and 300 wires.

THEODORE N. VAIL.

E. J. HALL.

From poles the wires soon overflowed to house-tops, until in New York alone they had overspread 11,000 roofs. These roofs had to be kept in repair, and their chimneys were the deadly enemies of the iron wires. Many a wire, in less than two or three years, was withered to the merest shred of rust. As if these troubles were not enough, there were the storms of winter, which were liable to wipe out a year's revenue in a single day. The sleet storms were the worst. Wires were weighted down with ice, often with three pounds of ice per foot of wire. And so, what with sleet, and corrosion, and the cost of roof-repairing, and the lack of room for more wires, the telephone men were between the devil and the deep sea—between the urgent necessity of burying their wires, and the inexorable fact that they did not know how to do it.

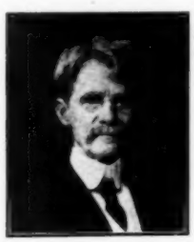
Fortunately, by the time that this problem arrived, the telephone business was fairly well established. It had outgrown its early days of ridicule and incredulity. It was paying wages and salaries and even dividends. Evidently it had arrived on the scene in the nick of time—after the telegraph and before the trolleys and electric lights. Had it been born ten years later, it might not have been able to survive. So delicate a thing as a baby telephone could scarcely have protected itself against the powerful currents of electricity that came into general use in 1886, if it had not first found out a way of hiding safely underground.

The first declaration in favor of an underground system was made by the Boston company in 1880. "It may be expedient to place our entire system underground," said the sorely perplexed manager, "whenever a practicable method is found of accomplishing it." All manner of theories were afloat, but Theodore N. Vail, who was usually the man of constructive imagination in emergencies, began in 1882 a series of actual experiments at Attleboro, Massachusetts, to find out exactly what could, and what could not, be done with wires that were buried in the earth.

A five-mile trench was channeled beside a railway track. It was dug handily and cheaply by the labor-saving plan of hitching a locomotive to a plow. Five plows were jerked apart before the work was finished. Then, into this trench were laid wires with every known sort of covering. Most of them, naturally, were wrapt with rubber or gutta-percha, after the fashion of a submarine cable. When all were in place, the willing locomotive was harnessed to a huge wooden drag, which threw the plowed soil back into the trench and covered the wires a foot deep. It was the most professional cable-laying that anyone at that time could do, and it succeeded, not brilliantly, but well enough to encourage the telephone engineers to go ahead.

Several weeks later, the two first cables for actual use were laid in Boston and Brooklyn; and in 1883 Engineer J. P. Davis was sent to grapple with the Herculean labor of putting a complete underground system in the wire-bound city of New York. This he did in spite of a bombardment of explosions from leaky gas-pipes; and with a woeful lack of experts and standard materials. All manner of makeshifts had to be tried in place of tile ducts, which were not known in 1883. Iron pipe was used at first, then asphalt, concrete, boxes of sand and creosoted wood. As for the wires, they were first wrapt in cotton, and then twisted into cables, usually of a hundred wires each. And to prevent the least taint of moisture, which means sudden death to a telephone current, these cables were invariably soaked in oil.

JOHN A. BARRETT.



W. D. SARGENT.

This oil-filled type of cable carried the telephone business safely through half a dozen years. But it was not the final type. It was preliminary only, the best that could be made at that time. Not one is in use today. In 1885 Theodore Vail set on foot a second series of experiments, to see if a cable could be made that was better suited as a highway for the delicate electric currents of the telephone. A young engineer named John A. Barrett, who had already made his mark as an expert by finding a way to twist and transpose the wires, was set apart to tackle this problem, with the able co-operation of Wm. D. Sargent, of Brooklyn. Four men were active together in this work, which was to greatly affect telephoning between distant points. They were

Edward J. Hall, Wm. D. Sargent, Thomas B. Doolittle and John A. Barrett, combining technical and business telephone efficiency of a high order. Being an economical Vermonter, Barrett went to work in a little wooden shed in the backyard of a Brooklyn foundry. In this foundry he had seen a unique machine that could be made to mould hot lead around a rope of twisted wires. This was a notable discovery. It meant *tight coverings*. It meant a victory over that most troublesome of enemies—moisture. Also, it meant that cables could henceforth be made longer, with fewer sleeves and splices, and without the oil, which had always been an unmitigated nuisance.

Next, having made the cable tight, Barrett set out to produce it more cheaply and by accident stumbled upon a way to make it immensely more efficient. All wires were at that time wrapt with cotton, and his plan was to find some less costly material that would serve the same purpose. One of his workmen, a Virginian, suggested the use of paper twine, which had been used in the South during the Civil War, when cotton was scarce and expensive. Barrett at once searched the South for paper twine and found it. He bought a barrel of it from a small factory in Richmond, but after a trial it proved to be too flimsy. If such paper could be put on flat, he reasoned, it would be stronger. Just then he heard of an erratic genius who had an invention for winding paper tape on wire for the use of milliners.

Paper-wound bonnet-wire! Who could imagine any connection between this and the telephone? Yet this hint was exactly what Barrett needed. He experimented until he had devised a machine that crumpled the paper around the wire, instead of winding it tightly. This was the finishing touch. For a time these paper-wound cables were soaked in oil, but in 1890 Engineer F. A. Pickernell dared to trust the tightness of the lead sheathing, and laid a "Dry Core" cable, the first of the modern type, in one of the streets of Philadelphia. This cable was the event of the year. It was not only cheaper. It was the best talking cable that had ever been harnessed to a telephone.

What Barrett had done was soon made clear. By wrapping the wire with loose paper, he had in reality cushioned it with *air*, which is the best possible insulator. Not the paper, but the air in the paper, had improved the cable. More air was added by the omission of the oil. And presently Barrett perceived that he had merely reproduced in a cable, as far as possible, the conditions of the overhead wires, which are separated by nothing but air.

By 1896 there were 200,000 miles of wire snugly wrapt in paper and lying in leaden caskets beneath the streets of the cities; and today there are 6,000,000 miles of it owned by the affiliated Bell companies. Instead of blackening the streets, the wire nerves of the telephone are now out of sight under the roadway, and twining into the basements of buildings like a new sort of metallic ivy. Some cables are so large that a single spool of cable will weigh twenty-six tons and require a giant truck and a sixteen-horse team to haul it to its resting-place. As many as 1200 wires are often bunched into one sheath, and each cable lies loosely in a little duct of its own. It is reached by manholes where it runs under the streets, and in little switching-boxes placed at intervals it is frayed out into separate pairs of wires that blossom at length into telephones.

Out in the open country there are still the open wires, which in point of talking are the best. In the suburbs of cities there are neat green posts, with a single grey cable hung from a heavy wire. Usually, a telephone pole is made from a sixty-year-old cedar, chestnut or juniper tree. It lasts twelve years only, so that the one item of poles is still costing the telephone companies several millions a year. The total number of poles now in the United States, used by telephone and telegraph companies, once covered an area, before they were cut down, as large as the State of Rhode Island.

But the highest triumph of wire-laying skill came when New York swept into the Skyscraper Age, and when hundreds of tall buildings, as high as the fall of the waters of Niagara, grew up like a range of magical cliffs upon the precious rock of Manhattan. Here the work of the telephone engineer has been so well done that although every room in these cliff-buildings has its telephone, there is not a pole in sight, not a cross-arm, not a wire. Nothing but the tip-ends of an immense system are visible. No sooner is a new skyscraper walled and roofed, than the telephones are in place, at once putting the tenants in touch with the rest of the city and the greater part of the United States. In a single one of these monstrous buildings—the Hudson Terminal, there is a cable that runs from basement to roof and ravels out to reach three thousand desks. This mighty geyser of wires is fifty tons in weight and would, if straightened out into a single line, connect New York with Chicago. Yet it is as invisible as the nerves and muscles of a human body.

During this evolution of the cable, even the wire itself was being remade. Vail and others had noticed that of all the varieties of wire that were for sale, not one was exactly suitable for a telephone system. The first telephone wire had been of galvanized iron, which had at least the primitive virtue of being cheap. Then came steel wire—stronger but less durable. But these wires were noisy and not good conductors of electricity. An ideal telephone wire, they found, must be made of either silver or copper. Silver was out of the question, and copper wire was too soft and weak. It would not carry its own weight.

THOS. B. DOOLITTLE

The problem, therefore, was either to make steel wire a better conductor, or to produce a copper wire that would be strong enough. Vail chose the latter horn of the dilemma, and forthwith gave orders to a Bridgeport manufacturer to begin experiments. A young mechanic named Thomas B. Doolittle was at once set to work, and presently appeared the first *hard-drawn* copper wire, made tough-skinned by a fairly simple process. Vail bought thirty pounds of it and scattered it in various parts of the United States, to note the effect upon it of different climates. One length of it may still be seen at the Vail homestead in Lyndonville, Vt. Then this hard-drawn wire was put to a severe test by being strung between Boston and New York. This line was a brilliant success, and the new wire was hailed with great delight as the ideal servant of the telephone.

Since then, there has been little trouble with copper wire, except its price. It was four times as good as iron wire,

and four times as expensive. Every mile of it, doubled, weighed two hundred pounds and cost thirty dollars. On the long lines, where it had to be as thick as a lead pencil, the expense seemed to be ruinously great. When the first pair of wires was strung between New York and Chicago, for instance, it was found to weigh 870,000 pounds—a full load for a twenty-two-car freight train; and the cost of the bare metal was $130,000. So enormous has been the use of copper wire since then by the telephone companies that fully one-fourth of all the capital invested in the telephone has gone to the owners of the copper mines.

For several years the brains of the telephone men were focused upon this problem—how to cut down the copper money. One uncanny device, which would seem to be a mere inventor's phantasy if it had not already saved the telephone companies $4,000,000 or more, is now known as the "phantom circuit." It enables three messages to run, at the same time, where only two ran before. A double track of wires is made to carry three talk-trains running abreast, a feat made possible by the whimsical disposition of electricity, and which is utterly inconceivable in railroading. This invention, which is the nearest approach as yet to multiple telephony, was conceived by Jacobs in England and Carty in the United States.

M. I. PUPIN.

But the most copper money has been saved, literally tens of millions of dollars, by persuading thin wires to work as efficiently as thick ones. This has been done by making better transmitters, by insulating the smaller wires with enamel instead of silk, and by placing coils of a certain nature at intervals upon the wires. The invention of this last device startled the telephone men like a flash of lightning out of a blue sky. It came from outside—from the quiet laboratory of a Columbia professor who had arrived in the United States as a young Servian immigrant not many years earlier. From this professor—Michael I. Pupin—came the idea of "loading" a telephone line, in such a way as to reinforce the electric current. It enabled a thin wire to carry as far as a thick one, and thus saved as much as $40 a wire per mile. As a reward for his cleverness, a shower of gold fell upon Pupin, and made him in an instant as rich as one of the Grand Dukes of his native land.

It is now a most highly skilled occupation, supporting fully 15,000 families, to put the telephone wires in place and protect them against innumerable dangers. This is the profession of the Wire Chiefs and their men—a corps of human spiders, endlessly spinning threads under streets and above green fields, on the beds of rivers and the slopes of mountains, massing them in cities and fluffing them out among farms and villages. To tell the doings of a Wire Chief, in the course of his ordinary week's work, would in itself make a lively book of adventures.

Even a washerwoman, with one lone, non-electrical clothes-line of a hundred yards to operate, has often trouble enough with it. But the Wire Chiefs of the Bell Telephone have charge of as much wire as would make *two hundred million clothes-lines*—ten apiece to every family in the United States; and these lines are not punctuated with clothespins, but with the most delicate of electrical instruments.

These Wire Chiefs must detect trouble under a thousand disguises. Perhaps a small boy has thrown a snake across the wires or driven a nail into a cable. Perhaps some self-reliant citizen has moved his own telephone from one room to another. Perhaps a sudden rainstorm has splashed its fatal moisture upon an unwiped joint. Or perhaps a submarine cable has been sat upon by the Lusitania and flattened to death. But no matter what the trouble, a telephone system cannot be stopped for repairs. It cannot be picked up and put into a drydock. It must be repaired or improved while it is working, by a sort of vivisection. It is an interlocking unit—a living conscious being, half human and half machine; and an injury in any one place may cause pain or sickness to its whole vast body.

And just as the particles of a human body change every six or seven years, without disturbing the body, so the particles of our telephone systems have changed repeatedly without any interruption of traffic. The constant flood of new inventions has compelled several complete rebuildings. Little or nothing has ever been allowed to wear out. The New York system was rebuilt three times in sixteen years; and many a costly switchboard has gone to the scrap-heap at three or four years of age. What with repairs and inventions and new construction, the various Bell Companies have spent at least $425,000,000 in the first ten years of the twentieth century, without hindering for a day the ceaseless torrent of electrical conversation.

[EDITOR'S NOTE.—This is the second part of a series of telephone articles by Mr. Casson on the History of the Telephone. Chapter II of "The Telephone and the Telephone System" will be followed by articles on "The Development of the Telephone Exchange," "The Telephone in Foreign Countries," and "Litigation Over the Telephone," each in two parts.

New Telephone Building in Philadelphia.

The Bell Telephone Company of Pennsylvania with its allied companies is about to remove its general offices to the new reinforced concrete building at the corner of Arch and Thirteenth streets, Philadelphia. The building has eight stories with a floor space of 64 by 120 feet. It will be used for executive-office purposes only, thus relieving the crowding at the exchange buildings at Seventeenth and Filbert Streets and at Eleventh and Filbert Streets.

Telephone Companies Merge.

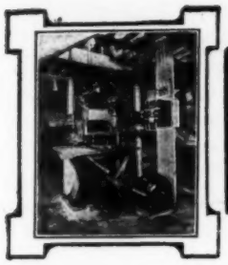
A certificate has been filed with the New York secretary of state showing that the New York Telephone Company had merged the New York and Pennsylvania Telephone and Telegraph Company. The certificate was signed by U. N. Bethell, president of the New York Telephone Company. T.

New Distributing Cable.

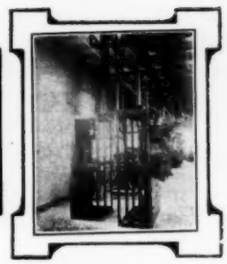
The Commercial Cable Company has just completed the laying of a third cable from Ireland to Weston on the English shore, which gives six distributing cables for the five that center on the Irish coast, and of these six, three now go through to London.

English Laboratory Opens.

The electrical laboratory presented to Oxford University by the Drapers' Company, and erected on the north side of the University Museum at a cost of $115,000, was formally opened on June 21.



Industrial Power



ELECTRICITY IN THE CONTRACTOR'S SERVICE.

AN ILLUSTRATED ACCOUNT OF THE USE OF ELECTRICITY IN EXCAVATING THE CHAMPLAIN BARGE CANAL.

At the present day when the time which is allowed for construction work must be reduced to a minimum, electricity is finding a wide application due to its inherent advantages, and in many places the electric motor is supplanting the steam engine. Electrical apparatus is especially serviceable to contractors and will be found to result in a great saving in time and money.

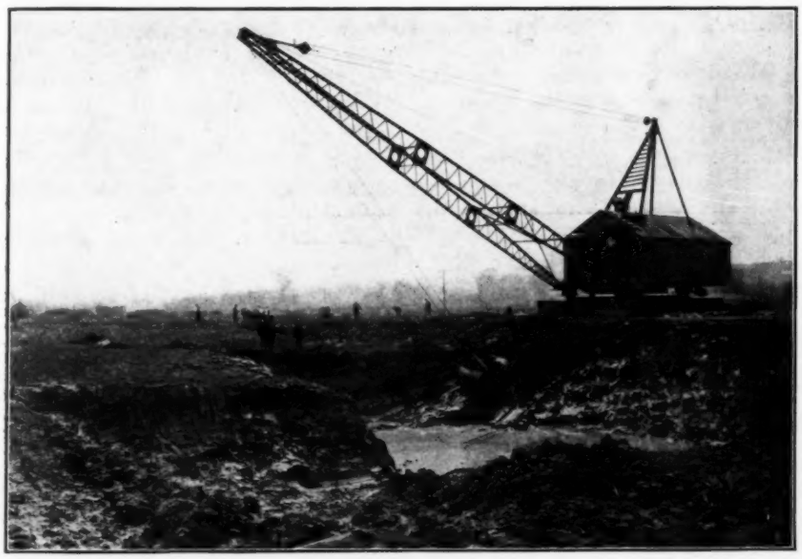


FIG. 1. ELECTRIC EXCAVATOR.—BUCKET DIGGING IN BANK OF CUT, CHAMPLAIN BARGE CANAL.

The electrical equipment is always ready for instant use, thus eliminating the loss of time in getting up steam when a steam engine is used.

Its use results in a reduction of expense, as one pays only for the power which actually does work. There is no consumption of power when the motor is not in operation. This eliminates the expense resulting from the consumption of fuel in order to keep up steam while the equipment is not in operation and to enable work to be resumed at any desired moment.

Any person of ordinary intelligence can operate an electrical equipment, and thus the high wages of a licensed engineer are saved.

The operation of an electrical equipment is not attended with objectionable and annoying features. There is no fire hazard due to flying sparks or live coals accidentally dropped from the boiler firebox, nor is there the nuisance of smoke, ashes and dust. The operator is not burdened with the responsibility of keeping sufficient water in the boiler, maintaining a hot fire to keep up steam, shoveling coal, removing ashes, etc. Its use eliminates the danger of water pipes and cylinders freezing and bursting in the winter time.

It is a very simple matter to install it and it can be relocated at will. Its position is not determined by features which limit its installation to certain points, as in the case of the steam-driven equipment, where steam or water supply pipes limit its location. After it has been moved to its new position the wires can be readily changed.

A good example of the use of electricity in contracting work is the recent work on the Champlain Barge Canal. The illustrations given herewith show the equipment of one of the electrically operated excavators which were used on this important undertaking.

This installation is unique in being one of the first to be equipped with induction-motor drive, and also to employ dynamic braking. All of the electrical apparatus was furnished by the General Electric Co., Schenectady, N. Y. From Fig. 1 it is seen that the bucket is controlled by two cables which are operated by the double-drum hoist shown in Fig. 2. This double-drum hoist is driven by a ninety-horsepower, forty-cycle, 550-volt, high-torque, three-phase, induction hoist motor. From Fig. 1 it is seen that the excavator is mounted on a circular track permitting its rotation through a complete circle, and making it possible to dump the bucket wherever desired within quite a large radius. The hoist for accomplishing this movement, shown in Fig. 3, is driven by a twenty-two-horsepower, forty-cycle, 550-volt, high-torque, three-phase, induction hoist motor.

The controlling apparatus shown in Fig. 4 consists of a group of contactors, interlocks, current-limit relays and a motor controller for the operation of the main drum hoist motor and the central of the speed of hoisting and excavating by varying resistance inserted in the motor circuit. This type of control, known as magnetic control, is essential in work of this class owing to the severe conditions. The operator is able to give a jerky movement to the bucket in order to shake clay and sticky mud from its bottom.

The motor is protected from overloading by a triple-pole circuit-breaker adjusted to trip at about fifty per cent above normal full-load current. This protection is necessary since the buck-

et may strike a rock or other hard substance embedded in the soil being excavated. The motor which rotates the excavator is also protected by a triple-pole circuit-breaker and is controlled by a drum-type controller with a bevel gear and lever device instead of the ordinary handle.

The two drums for hoisting and digging are each provided with an air brake for retarding the movement of the bucket or boom when these are being lowered. This equipment consists of an air compressor of nineteen cubic feet displacement driven by a six-horsepower, forty-cycle, 550 volt, induction motor and controlled by an automatic pressure governor which starts the motor when the pressure falls below a certain value. As soon as the required pressure is restored, the controller automatically stops the motor. For controlling the air brakes, two valves of the type designed for electric-car service are provided. These may be seen in Fig. 4, next to the master controller.

Two of these excavators were employed. Power at a potential of 6,600 volts and a frequency of sixty cycles was purchased from the Hudson River Power Company and stepped down to 550 volts for operation of the motors by a bank of three type H, sixty-kilowatt transformers. The transformers and transmission line are shown in Fig. 5.

A triple-pole oil-switch and a lightning arrester, both designed for operation on a 6,600-volt system, are installed in the temporary building beside which the transformers are located. The transformers and building are mounted on skids to facilitate moving the apparatus as the work progresses.

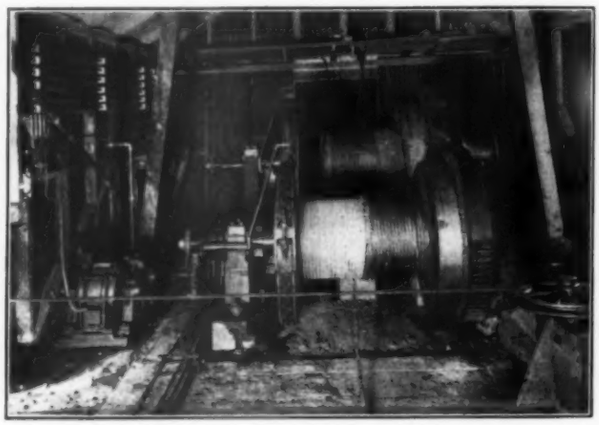


FIG. 2.—DOUBLE-DRUM HOIST, ETC., ON EXCAVATOR

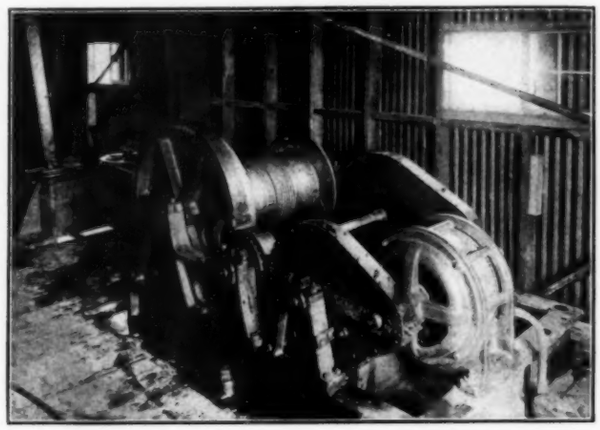


FIG. 3.—SINGLE-DRUM SWINGING HOIST ON EXCAVATOR.

FIG. 4.—INTERIOR VIEW OF ELECTRIC EXCAVATOR.

FIG. 5.—TRANSFORMER PANEL AND OIL SWITCH, ON SKIDS.

To Generate Electricity by Tunnel Drainage.

According to present plans, the drainage from the Roosevelt Tunnel, Cripple Creek, Col., which it is estimated will amount to 15,000 gallons an hour, will be used to generate electricity for mining plants.

Electricity in Mining.

In the course of a paper on "Coal-Mine Equipment," presented at the Bluefield meeting of the West Virginia Coal-Mining Institute, W. S. Meyers gave a résumé of his experience of the trend of electrical progress in mining work. An abstract of the author's conclusions follows:

In the application to work inside the mine there is no form of energy which compares to that of electricity.

The comparative merits of air and electric locomotives resolve into the determination as to whether or not the main haulways are gaseous.

The present tendency in electric-locomotive construction is toward the reduction in the weight of each unit to ten tons and less, operating them in tandem when heavy trips are desirable, the advantages being in the use of lighter rails and in the reduction of track maintenance costs and in shorter wheel base. Tandem locomotives are usually so equipped that either unit may be run independently with little

or no trouble in changing connections.

It has been the practice of mine locomotive builders to ascertain from the prospective purchasers the operating conditions at the mine for which the locomotive is intended and to equip it with motors just sufficient to meet the given loads with the maximum allowable temperature rise. A much better plan is to build them regardless of mine conditions with motors large enough to withstand the severest treatment. The rule is to increase the size of the trip up to the point where the drive wheels begin to slip. The locomotive motors should have a combined output of from ten to twelve horsepower per ton of weight based upon an hour rating at a maximum temperature rise not to exceed seventy-five degrees centigrade above air temperature. Motors having a combined capacity under these limits will be liable to heat excessively under heavy loads, and with a greater capacity there arises the disadvantage of having to run too long a time upon resistance with medium and light loads, resulting in diminished economy.

In connection with electric haulage there is no feature of importance which receives so little attention as that of rail bonding. In the mine, light springy rails, soft roadbed, insufficient number of ties, the large number of wheels passing over the joints, loose fishplates, corrosive mine water, and absence of good light are some of the drawbacks which often cause the expenditure of large sums for copper feeders and then experience heavy drops in voltage because the electric fluid has to force its way back to the generator through a lot of high-resistance bonds. If these bonds are placed outside the fishplates they are apt to be broken or loosened, and if placed under the plates they are usually held as in a vise destroying their flexibility and life.

In regard to the proper voltage for mine work: Considered from the point of economical production the higher the voltage the better. Considered from the safety of the men and live stock, the reverse condition applies. The voltage is in some installations fixed at 250 and in others at 500, the former requiring four times the outlay for copper in comparison with the latter, capacity and distances being equal. Fatalities of authentic record from 250 volts are very rare. Where voltages of 500 are used there have been recorded a few deaths due to electric shock. In mines of large output the difference between the 250 and 500-volt systems in cost of copper may amount to $8,000 or $10,000, and if, upon opening up a 500-volt mine, this sum were set aside and added to the usual amount allowed for mine timbering and ventilation, it is safe to predict that the decreased number of fatalities from falls in roofs and explosions would much more than offset the number due to contact with live wires.

Our state legislators should hesitate long before passing laws limiting the voltage in mines to 250, but laws compelling stringent and efficient inspection of all electric lines and appliances inside the mines should be enacted and enforced. In manways and other parts of the mine much frequented by men and live stock, the feeder wires, if there are any, should be placed in a groove mined out in the rib about two feet above the pavement.

The advantages of a central plant over local plants at each mine may be itemized as follows: Saving in fuel, saving in wages of station attendants, saving in cost of conductors, flexibility and variability in voltage. It is not always easy to get a sufficient amount of good boiler water at mine openings and often the facilities for providing boiler coal are expensive, and in such cases the central distribution system shows up to advantage, for the substations require neither water nor coal, and can be relocated as the working district advances with a minimum amount of expense.

The first cost of the average 300-kilowatt direct-current plant should figure from $50 to $60 per kilowatt, including the building, and the cost of the central plant of about 2,000 kilowatts will be from $80 to $100 per kilowatt.

The capacity of the central station can with safety be placed at about seventy-five per cent of the aggregate peak load requirements of the mines served, for the reasons that the peak loads seldom or never occur simultaneously, and the load factor per unit can be maintained much better in the central station, with a corresponding betterment in economy.

The installation of a small direct-current plant is justifiable where electric power is required for two or three fair-sized mines in a territory in which there is no existing central plant. One such plant may serve two or three mines within a radius of about one mile from a plant having a voltage of 250, or about three miles from a 500-volt plant. Where there is a larger number of mines in the same territory, economical power generation will usually mean a central plant using alternating-current equipment with the transmission lines carrying voltages in accordance with the distances between the power house and the most remote substations.

In plants of 500 kilowatts and larger it is always advisable to install two or more units rather than one large one, even if one of the units is a spare one, in order to provide against complete shutdowns, and for better economy at light loads.

In plants having a capacity of 1,000 kilowatts or more the tendency is to install water-tube boilers with a working pressure of from 140 to 175 pounds, and a brick stack will usually figure the cheapest and best in the long run. Where the hand-fired boiler plant is too large to be handled by one fireman, automatic stokers will usually effect a saving, especially if the coal can be deposited in the bunkers without the use of complicated machinery.

Three-phase, delta-connected generators and motors are almost invariably used in such plants with a frequency of either twenty-five or sixty cycles. If the longest transmission line is eight miles or less, 300 kilowatts may be delivered at the end of the line composed of three No. 6 copper wires without the use of transforming apparatus in the power station, and motor generators may be employed at the substations on moderate-length transmission lines, doing away entirely with the use of transforming apparatus.

In mines where a direct-curent voltage of 250 is in use and in which the working district is at a considerable distance from the mine mouth, a great saving in copper can be made by placing the ordinary substation equipment inside the mine in the center of the working district, carrying the alternating-current transmission wires overland to and through a bore hole leading to the underground substation. Where practicable, this substation should be located near a large mine pump or electric hoist in order that one attendant may serve both stations.

For driving mine pumps, small fans, and other machinery, where constant speed and extended periods of operation are required, alternating-current motors of the induction type are generally more economical and more reliable than are direct-current motors, and can be operated without increasing the load upon the substation equipment.

In designing the central power system it is sometimes decided that all the necessary power for whatever purpose shall be electric, no boilers nor engines being installed at the mines. This practice is, in general, correct, but there are some instances in which the wisdom of so doing is not apparent. Take the case of a mine in the central power station territory at which there is to be installed on the outside near the main entry a hoist and a fan each requiring from 150 to 300 horsepower. If driven by electric motors, the advantages due to the superior economy in power production in the central station are largely overcome by the losses in the motors and in the transmission line, and direct-connected steam engines depending neither upon generators and motors nor upon transmission lines, would have the advantage of greater reliability and superior speed variability. Then, if the mine is a dusty one, the exhaust steam from the fan engine is very valuable for heating and moistening the air forced into the mine—a practice which is in recent years very common.

For driving small machines outside of the mine, especially those in isolated places, such as pumps, small fans, crushers, shaking screens, box-car loaders, coke-oven larries, auxiliary hoists, and others of this class, it will generally prove advantageous to install electric motors.

Electricity in Kansas Mines.

A recent dispatch from Galena, Kan., states that a large new 200-ton mill, thoroughly modern and operated by electricity, has been installed on the property of the Mess Mining Company. Furthermore, the Diplomat mill on the Galena land is to be started soon, and this plant will be electrically operated.

Electric Power for Quarries.

Advices from Carthage, Mo., state that the Spring River Power Company will shortly construct a substation to furnish electricity to quarries along north side of Spring River.

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

F. E. NEWBERRY & COMPANY, St. Louis, Mo., received the contract for the installation of an electric lighting system at Fort Crockett, Texas. The contract price for the work is $11,943.97.

THE S. L. ELECTRIC COMPANY, of Toledo, O., has leased a store room at 234 Michigan Avenue. The firm, which was incorporated a short time ago, will do a general electrical engineering business.

THE INTERSTATE SUPPLY COMPANY, Sioux City, Ia., was awarded the contract for the erection of the electric-light plant at Paulina, Ia., The amount of the company's bid was $11,500.

THE BRODERICK-BOLTE ELECTRICAL COMPANY, East St. Louis, Ill., was recently incorporated with a capital of $15,000. The incorporators are Frank B. Bolte, C. F. Bolte, and George Chartrand.

THE BARDEN ELECTRIC AND MACHINERY COMPANY, Houston, Tex., has been awarded the contract for the electric wiring and electrical equipment for the new factory of the National Biscuit Company in Houston.

THE INTERSTATE SUPPLY COMPANY, Sioux City, Ia., secured the contract for erecting the electric-light plant at Paullina, Ia., for a contract price of $11,500. Mietz & Wiess oil engines are to be used for power. The contract calls for completion of the work by October 1.

THE LAWRENCE GOODSPEED ELECTRIC COMPANY, Virginia, Minn., has received the contract for the installation of a "White Way" on Chestnut Street of that city. The posts will be supplied by the Flour City Ornamental Post Company of Minneapolis, Minn.

THE McKAY ENGINEERING COMPANY, Baltimore, Md., received the contract for making the underground connections for the Broad Street ornamental lights in Richmond, Va. The work includes the installation of an underground conduit with junction boxes, manholes and service connections.

J. WAHLMAN & SON, Negaunee, Mich., have been awarded a contract for the erection of a powerhouse at the Smith mine, also a crusher and ore sampling house at the Austine mine, on the Swanzey range, both of which properties are operated by the Cleveland-Cliffs Iron Company.

THE J. T. KEMP ELECTRICAL COMPANY, of Findlay, O., opened for new quarters at 530 South Main Street business, a short time ago, its new quarters at 530 South Main Street. J. T. Kemp and H. J. Burket own the establishment. They have a very attractive store.

International Telegraph Tournament.

The Italian Government has decided to hold in the summer of 1911 at Turin, in connection with the International Exposition of Labor and Manufactures an international competition of practical telegraphy. This competition, which has for its aim the awakening of a new interest among all telegraph employees and to encourage them to perfect themselves in the use of the apparatus, is open to telegraphers in the service of the government administrations and the companies belonging to the International Telegraphic Union, as well as to the other administrations and private companies. The competition will consist of a trial of sending and receiving by Morse, Hughes or Bandot apparatus, either individually or between representatives of the administrations or private companies who take part.

The trials will be judged according to special rules by a jury in which the visiting administrations will be equitably represented. The jury will have at its disposal as a reward for the winners prizes in money, medals and objects of art. Letters of invitation to take part in this tournament have been sent out to all of the administrations and private companies. A committee has been appointed to draw up a set of rules and this committee will be glad to receive suggestions from any of those interested. This competition is being planned with the object of strengthening the feeling of friendship which already exists between telegraphers of different nations. M. Ferdinand Geronimi, minister of posts, Rome, Italy, is in charge of the plans for the affair.—*Telegraph and Telephone Age.*

American Society for Testing Materials.

A short account of the annual convention of the American Society for Testing Materials, which was held at Atlantic City June 28 to July 2, was given in our last issue. Abstracts are given below of the papers by A. W. Carpenter on "Test of a Structural Steel Plate Partly Fused by Short-circuited Electric Current," by E. W. Lazall on "Comparative Tests of Lime Mortar, both in Tension and Compresison, Hydrated Lime and Sand, Lump Lime and Sand, and Cement Lime and Sand," by G. W. Thompson on "Classification of Fine Particles According to Size" and "Another Solubility Test on Protective Coatings," and by C. H. Chapman on "Some Exposure Tests of Structural Steel Coatings." The paper by Chas. W. Burrows on "A Comparison of Magnetic Permeameters" is given in full on pages 123, 124 and 125.

Following the reading of the report of the committee on preservative coatings, a communication from Cyril de Wyrall, chief inspector of the New York subway system, was presented in which he advocated that the melting point of bitumen used for waterproofing should be raised to 200 degrees Fahrenheit, that felt should not be used for waterproofing and two-ply close-woven fabric substituted for it; he also contended that no expense should be spared to thoroughly waterproof a subway system, such as that of New York, as it meant economy in the end.

TEST OF STRUCTURAL STEEL PLATE PARTLY FUSED BY ELECTRIC CURRENT.

The electrification of the New York Central & Hudson River Railroad out of the Grand Central Station at New York City involved carrying electric third rail and electric power cables over the steel Park Avenue viaduct, about 1.25 miles long. The cables were placed in steel tube conduits just over the tops of the girders on which the conduits were supported on wooden blocking. On June 22, 1907, a short circuit took place which fused the conduit pipe and burned the underlying girder cover plate, the burn extending clear through the plate at one point, which was about the center of the plate. The conduit metal and cable copper were fused into the plate. The injured portion of the plate was cut off and replaced with a new plate properly spliced to the remaining portion on the girder, in due course of repairs. It was thought desirable to determine the extent of the injury to the strength characteristics of the plate due to any possible change in the character of the material; that is, any injury aside from the mere loss of section. The removed portion was, therefore, sent to the Watertown arsenal for tensile tests, and microscopic examinations of the structure of various parts were made. Microscopic examination shows that the parts unaffected by the fusing showed a fine structure without distinct granulations and with the excess of ferrite common to low-carbon bridge steel. The structure of the fused portions was changed and enlarged, from which it was concluded that the material would be rendered brittle, and this was borne out by the subsequent tensile tests. The welding of the copper and steel from the conductor and conduit with the steel of the plate, was complete and did not show distinct inclosures of any oxides between the surfaces. The general structure of the plate showed a number of original inclosures of oxides such as are commonly found in all plates. It was considered that the original material should be classed as excellent. The conclusion drawn from these tests was that the character of the metal was changed by the electric burning, but that the injury did not extend far beyond the limits of the visible burning. This local change in the character of the metal was enough, however, to reduce the static strength of the plate tested as a whole some forty per cent and to destroy its ductility; from which it was further concluded that a plate with a similar injury would be unrealiable for service, and that if the local injury were cut away the balance of the section could be depended upon to develop practically the same unit strength as prior to the injury. The damage to the plate is considered due to the heat produced, in which electricity was merely the producing agent, and it is thought that a similar amount of heat produced in any other way and applied to the same parts for the same period of time would have given the same results. The short circuit which caused the injury developed between the 660-volt direct-current conductor and the steel conduit, and was probably due to a defect in the insulating wrapping at a joint in the cable. The damage would probably have been confined to the cable and conduit had it not been for failure of a circuit breaker, as a result of which failure was continued for a considerable period of time.

COMPARATIVE TESTS OF LIME MORTAR.

Rrom the results of a long experimental investigation the author concludes that the use of a Portland cement mortar for brick work cannot be recommended for general practice because of the lack of placticity which prevents the bricklayer from making a good joint and bedding the bricks thoroughly and evenly. For this very reason it is customary where Portland cement mortar is specified, to add a gauging of lime to improve the spreading quality of the mortar. The same principle applies to stuccoes or plaster containing Portland cement. To obtain the best results, lime should be used in order that the stucco may be spread with less labor, and a good clinch through the lath be assured. In general all lime mortars whether they contain Portland cement or not are stronger when prepared from hydrated lime than when prepared from quicklime. In the common method of slaking, the paste or mortar must be aged for a considerable time to insure the complete hydration of all the quicklime particles. It is often stated that limes made from stolomite are unsuited for use in mortars containing Portland cement because of their high magnesium content. The present investigation indicates, however, that such limes are desirable and show no signs of disintegration even after years of exposure to the elements.

CLASSIFICATION OF FINE PARTICLES.

It is almost impossible to classify many cements and pigments according to the size of their particles because fine enough screens are not made; even the finest silk cloth is not suitable. An attempt was therefore made to devise a new system of classification of very fine particles. The principle employed was that the rate of fall of substances in fluids depends on their specific gravity and the surface they expose, that is, the large particles fall more rapidly than the smaller ones. The apparatus used consisted of four brass cones placed one above the other so that the overflow from the top cone discharges into the bottom of the second cone, the overflow from the second cone passes into the bottom of the third cone, etc. Kerosene is the fluid used. Each cone has a base area twice that of the one above, so that the fourth cone has one-eighth the speed of flow that the first one has and the smallest particles caught in the fourth cone should be one-sixty-fourth of the diameter of the smallest particles caught in the first cone. The apparatus has been used mostly in the classification of white lead and seems to be quite reliable as a means of separating other fine materials into grades according to the size of their particles.

SOLUBILITY OF PROTECTIVE COATINGS.

This paper describes a test to determine whether certain pigments contained any soluble compounds that would be washed out by rain. Six white pine boards were painted with various mixtures of pigments varying by twenty per cent. Two coats were applied and when thoroughly dry the boards were put in a rack and their lowest sides were sprayed with distilled water twice a day. After some months all the boards containing pigment "b" showed a brownish scum on the surface which gradually increased in thickness. The formation of this scum seems to account for the washing and streaking of paint in numerous instances.

EXPOSURE TESTS OF STRUCTURAL STEEL COATINGS.

About three and one-half years ago Westinghouse, Church, Kerr & Company undertook the testing of a large number of samples of so-called steel preservative paints. The paints were applied in each instance to two thin steel plates two by six inches in size, one plate being given one coat and the other plate two coats. Samples have been added from time to time until now over 1,600 plates have been used on which were applied 530 paints. In each case the plate was scratched on opposite corners so as to cut through the paint and expose some of the metal. The plates were then exposed to the weather on top of the company's building in New York City. In each case rusting occurred, starting at the exposed scratched mark extending more or less over the entire plate. It was observed that the different classes of paint rusted in different ways. In every case the samples with two coats showed much less rusting than those treated with only one coat; this was more marked at the end of two years than at the end of the first year. The paints classified as red leads gave the best results, that is, least amount of rusting, at the end of two years with both single and double coats. Next in rank at the end of two years with two coats were: Zinc oxides, iron oxides, carbons, graphites and chromates.

International Association of Municipal Electricians.

The fifteenth annual convention of the International Association of Municipal Electricians will be held in the Convention Hall, at Rochester, N. Y., September 6, 7, 8 and 9, 1910.

The following papers will be presented: "Wireless Telephone and Telegraph;" "Lightning Protection;" "Mercury Arc and Other Rectifiers;" "Relation of the Telephone to the General Organization of Fire-Department Service;" "Underground Work;" "Modern Police Telegraph System."

New Electrical and Mechanical Apparatus and Appliances.

A New Galvanized Conduit.

The American Circular Loom Company, Boston, Mass., is manufacturing and placing on the market a new conduit for electric wiring which is meeting with much favor on account of its many advantages.

"X-Duct," which this new conduit is called, is a steel tube which has received first an electro-deposited layer of copper and then, on top of the copper an electro-deposited coating of zinc. It is manufactured in ten-foot lengths, threaded at both ends, with coupling.

The layer of copper forms an impervious covering of corrosion resisting power. It is of value, not only because of the preservative value of the copper layer, as such, but also because it makes practical the preliminary plating of the tube in a definitely alkaline medium and insures uniform surface resistance while the zinc is being deposited.

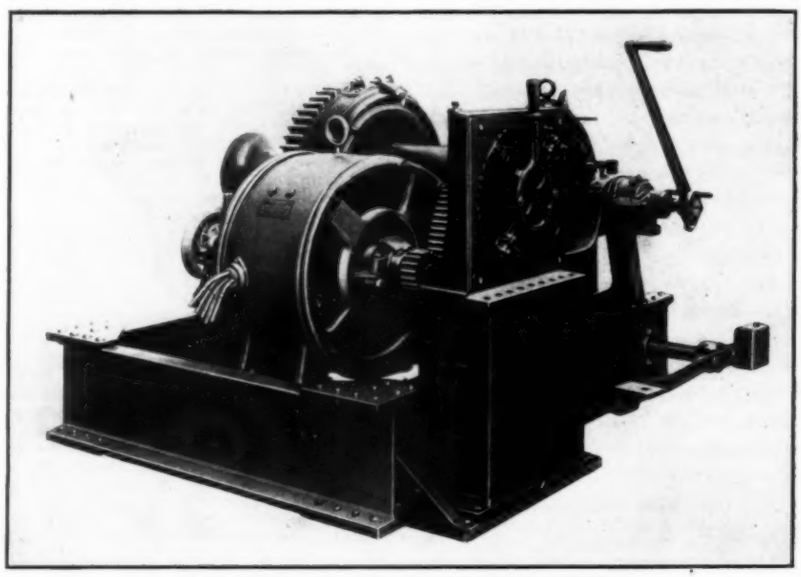
The coating of zinc is deposited uniformly and continuously. The primary reason for applying a zinc coating to the tube is to preserve it and prevent corrosion.

"XDuct" bonds with concrete and adds to the strength of a structure. The exterior surface of the tube is clean, so that the concrete mixture wets the surface of the conduit thoroughly throughout its entire length and subsequently bonds with it. It thus preserves the area of the cross section of the concrete, thereby maintaining its strength, and does not allow the formation of pockets in which corrosive elements might accumulate and inaugurate corrosion.

The interior of the tube has a lining of alkali-and-resisting enamel which reinforces the insulation on the wires. It is said to be entirely free from blisters, burrs, or any obstructions, and presents an even, smooth and glossy surface which facilitates the insertion of the wires without danger of abrasion of the insulation and allows of their being readily withdrawn if necessary. It permits bending in curves of short radii without cracking and is not affected by rapid and great changes in temperature.

Portable Electric Hoists for Rental.

Novel ideas, when practical, are at a premium. Their speedy adoption and modification to meet varying local conditions, mark the progressive engineer, the energetic salesman and the growing industry. "Practical Novelty" is the key note of all modern enterprise; it has, however, for obvious reasons found a broader exemplification in the electrical field than elsewhere. The accompanying illustration shows a portable hoisting outfit designed by the Rochester Railway and Light Company, and equipped with a Westinghouse motor. The design has proven very effective and has been duplicated for a considerable number of central stations and contractors.



MOTOR-DRIVEN PORTABLE HOISTING OUTFIT.

In addition to those already sold, the Rochester Railway and Light Company has retained two completely equipped hoists in stock for rental to contractors, at a nominal charge of $2 to cover costs of delivering and installing the hoist. For local service direct-current motors are used. Several alternating-current motors, which can be mounted interchangeably with the direct-current motors, are also held in stock and substituted when the hoists are to be used in outlying districts of the city. No extra charge is made for changing the motors.

The advantages of an electric hoist are numerous and striking. It is compact, durable and self-contained; fuel and water supply need not be considered; the smoke nuisance is eliminated; depreciation at all loads are insured. When equipped with an electric brake, the hoist is absolutely automatic, a single lever giving both power and brake control. In case of interruption to service the electric brake is automatically set, while a mechanical brake actuated by a foot lever affords additional protection. A suitably arranged friction clutch allows the drum to rotate independently of the motor, when lowering the load. Actual average cost of continuous operation at rated capacity on recent construction, sixty cents per day.

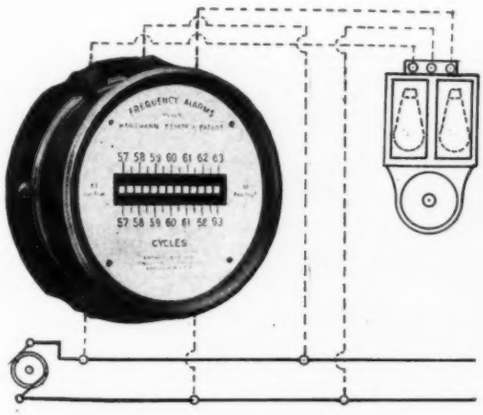
New Gas-Engine Units for Gary.

Announcement has been made at Gary, Ind., of the placing of an order by the United States Steel Corporation with the Allis-Chalmers Company for six gas engine driven units, which will increase the corporation's power plant in Gary twenty-five per cent. There will be a total of thirty-one gas engines with a combined capacity of 150,000 horsepower, the largest power plant of its kind in the world. The units will operate by gas from blast furnaces.

Frequency-Variation Alarm Instrument.

Machado & Roller, 203 Broadway, New York, N. Y., are the sole United States agents for the Hartmann & Braun frequency-variation alarm shown in the accompanying illustration. This instrument is a standard resonance-type frequency meter within whose case there is mounted a pair of relays which likewise are operated on the resonance principle.

In the particular range which is shown in the illustration, the normal frequency of the plant is sixty cycles and the two relays are adjusted, the one to come into play at fifty-nine cycles and the other at sixty-one cycles. Through means of these relays and with the wiring connections as indicated by the dotted lines, the combination optic and accoustic alarm comes into operation whenever these limits are exceeded.



FREQUENCY VARIATION ALARM.

The lamps which form the optical alarm are behind differently colored glass screens, so that it is evident at a glance whether the difficulty is excessive speed or insufficient speed. The operation of the frequency indicating reeds themselves is in no wise interfered with by the presence of the relays, so that the instrument serves the same indicating purpose as does the ordinary model.

New Russian Wireless Stations.

The Russian Government proposes to build wireless stations for the merchant marine at the port of Libau, at Bolderaa (mouth of the Dvina), and on Runo Island (Gulf of Riga).

The New Peerless Testing Set.

A new and handy testing set, in the form of a switch-type dial decade set, shown in the accompanying illustration, has just been put on the market by the Thompson-Levering Company, 244 Arch Street, Philadelphia, Pa., and is unique in construction and design.

The rheostat is composed of four dials of the values of units, ten, hundreds, and thousand ohm coils, ten coils to each dial. The bridge arms A and B have values of one, ten, 100 and 1,000 ohms to each arm, thus giving a very wide range of measurement. This set is equipped with the quick make-and-break switches, enabling the tester to go rapidly from one test to another, making it very easy to manipulate.

The brush of this set is of a special design, made of the best spring phosphor bronze, and is so designed as to insure excellent spring contact. These brushes are carefully ground, and slide over the contacts evenly and smoothly, and the contact resistance is negligible. Another feature in connection with these brushes is the fact that they can be swung from the highest to the lowest value coil, without going back over the intermediate blocks, thus making a complete circle. There is also an Ayrton shunt as part of this apparatus, allowing the use of full current, one-tenth part of the current or one-hundredth part of the current to flow through the galvanometer, or outside the galvanometer, as desired.

The galvanometer is of the D'Arsonval type, and has a very high sensibility. It is claimed to be quick and positive in its action, and extremely dead-beat, thus making readings very easily and quickly. The galvanometer key is arranged with a short-circuit device, which also helps to bring the needle to rest promptly.

The batteries in the case consist of four commercial size cells, which may be replaced very easily, as the tester can buy them in any supply house. These cells are replaceable by removing four small screws, which releases the cell block in which the new cells are put; this block is then slipped back into place and screwed in, the operation taking but a very few minutes, and the rest of the set being entirely undisturbed.

Provision is made, by means of binding posts on the set, for outside battery, in case a higher electromotive force is required than that of the cells contained in same. Provision is also made, by means of binding posts, for use of an outside galvanometer, in case a very high sensibility instrument is required for special insulation measurements.

The rheostat coils are adjusted to an accuracy of one-tenth of one per cent, and the bridge-arm coils to one-twentieth of one per cent, so that these coils, in connection with the high sensibility of the galvanometer, allow very accurate readings to be taken.

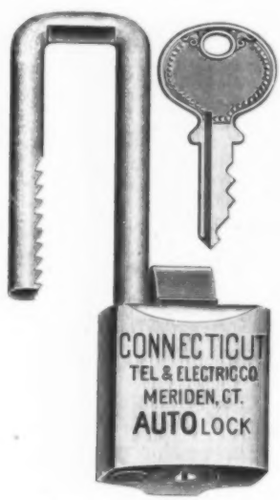
The size of the set is nine and one-quarter inches long by five and three-quarter inshes wide by five and one-half inches deep.

PEERLESS TESTING SET.

Paragon Ground Cone Sales.

The Paragon Sellers Company, 48 Fifth Avenue, Chicago, Ill., announce that they have been getting some very satisfactory business on the Paragon ground cone. This cone is especially designed for grounding purposes in the electric railway, light and power field.

It is made of solid copper and is completely equipped ready to install. All that is necessary is to "bore a hole and drop it in." The cone is made in two sizes and two gauges of copper, viz., No. 25 and No. 21. It is equipped with a hollow cable running its entire length of 61,968 circular mills cross section. The ground wire is run into this cable clear to the bottom of the cone so that absolutely perfect contact is made. There are numerous perforations in the cone (seventy-five to the square inch) which act as discharge points and also allow the charcoal with which the cone is filled, to absorb moisture. It has been found that much of the resistance between the grounding device and the ground itself is in the immediate point of contact between the grounding device and the earth.



AUTOMOBILE LOCK OPEN.

The moisture attracted by the cone reduces this resistance to a minimum and is evidently an important feature.

The ease with which the cone can be installed is one of its great advantages. Each cone is packed in a box by itself and can be shipped by the hundred on a wagon and dropped off at each point of installation along the line. This does away with the carting of loads of charcoal, cumbersome plates or junk copper, etc.

Connecticut Automobile Lock.

Stealing automobiles seems to have become almost as common as stealing bicycles. A new lock device, to prevent the theft and use of car without owner's permission, has been placed on the market by the Connecticut Telephone and Electric Company, Meriden, Conn., which will no doubt meet with instant approval.

In using this lock, it is simply necessary to apply the emergency brake lever and place the lock in the adjacent notch of the segment on the release side. On cars where the clutch is disengaged by the first movement of the lever before the brake is applied, the car can be locked without brake being applied, and with only clutch being disengaged. In the latter position the car could not be run, but could be moved which is sometimes desirable, especially if left in a public garage.

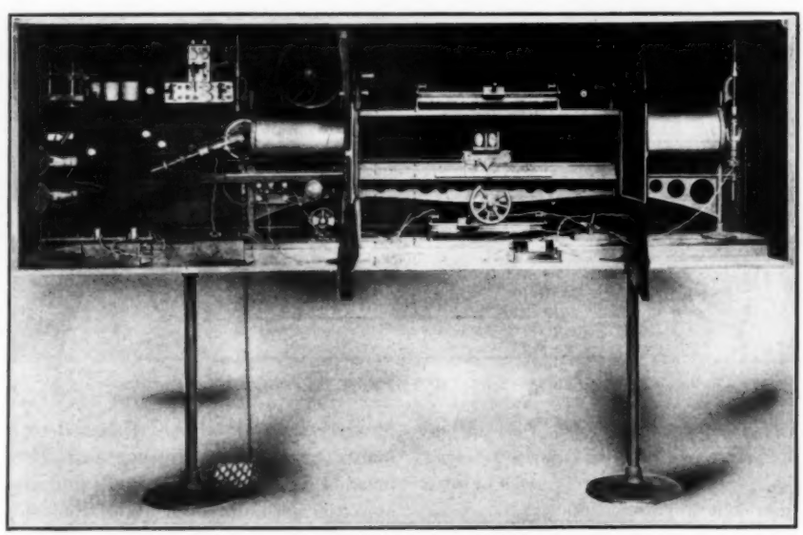
AUTOMOBILE LOCK APPLIED TO CAR.

This lock is of the high grade Yale type made from the solid block, and all keys are different. The lock is very simple to apply and makes a positive lock against the stealing of the car.

Electric Incandescent Lamp Testing Apparatus.

Purchasers of incandescent lamps desiring to install a testing outfit and who do not have at their disposal a dark room will doubtless be interested in the photometric apparatus shown in the accompanying illustration and which has just been placed on the market by the Dwyer Machine Company, of Lynn, Mass. The photometer is inclosed within a large case which, together with the curtains, protects the sensitive screen from stray sources of light. The inside of the case is darkened and the inside of the photometer proper is lined with black velvet. Photometers are supplied for measuring tungsten lamps up to 1,000 candlepower.

Lamps may be lighted on testing sockets independent of the photometer and graduated by means of rheostats from a red heat to candlepower or above. This is for the purpose of discovering bright spots on the filaments. Lamps with filaments differing in brightness or with filaments not of a uniform temperature throughout their length are considered defective.



INCANDESCENT-LAMP TESTING APPARATUS.

Another important test for which provision is made is that of vacuum. Of all the tests made on incandescent lamps, undoubtedly, the most important is for vacuum and lamps with a poor vacuum will not give satisfactory service. The instructions accompanying the apparatus describe ten degrees of vacuum and indicate the life which can be expected from each.

New Switch and Receptacle Boxes.

The Economy Switch Box and Manufacturing Company, 5305 Sweeney Avenue, Cleveland, Ohio, is placing on the market a line of switch and receptacle boxes which have many commendable features.

A view of one of these boxes and the method in which it is installed is shown in the accompanying illustration.

The ears of the Economy boxes are longer than usual, thus enabling the installer to place the switch outlet near the door casing without fear that the box will be partially covered by the casing. For installing, only one wood support is necessary, beside the studding.

The box is so constructed that when installed in a two-inch partition or sliding door casing, the door will not strike the box on its forward or backward movement and will not cause mechanical injury to the wiring construction.

The receptacle boxes are two inches deep, weigh seven ounces and are made of cast iron or pressed steel. The switch boxes are the same size as the receptacle boxes and are made of pressed steel, japanned and shearadized.

The pressed steel boxes may be made up in gangs without removing or replacing any part of a single box, it being only necessary to place them side by side and secure by means of a key-way and rivets with which the boxes are equpiped.

Correction.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for June 11 there appeared a notice to the effect that the Edison battery would be listed as regular equipment on the Ohio Electric Car Company's vehicles. The company states that its regular equipment is still the Exide battery, but that any other battery will be furnished as desired.

The Tape Output in America.

The vastness of the annual American output of insulating tape can be appreciated from the fact that the production now amounts to nearly 400,000,000 yards, or over 200,000 miles and is rapidly increasing. The gain from year to year is, of course, due mainly to the growing employment of electricity, and the use of insulating tape on practically every new machine or piece of wiring, to say nothing of repair work. For this reason, backed by the requirements of the Fire Underwriters, and the insulation made compulsory by state and municipal regulations, the demand is likely to increase still more rapidly in the future.

The call for "more tape" is so urgent that the Massachusetts Chemical Company, whose plant at Walpole, Mass., is said to make even now fully half the tape output of the country, is adding two and one-half acres of new floor space to its factory equipment. The plant has several times been enlarged, and its daily output already amounts to several hundred miles of three-quarter-inch tape; but this is far below the demand. The call for this company's product alone seems to show that the annual output of the country will in two or three years probably exceed one billion yards.

A German Aviation Office.

Consular Agent George A. Makinson, of Sorau, states that an aviation office, for the study and exposition of various types of aeroplanes, has recently been established at Breslau for the provinces of east and west Prussia, Posen, and Silesia. The work is divided into several classes or divisions, each under the direction of a highly trained specialist. Special attention will be devoted to examining and elucidating problems concerning motors designed for aeronautical purposes and atmospherical instruments.

Bayonet-Lock Sockets.

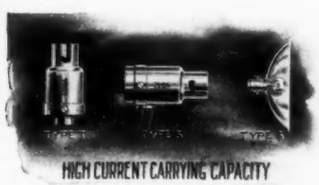
The use of electricity in side and tail lights on many 1911 automobiles shows how keenly manufacturers of these cars analyze the public's demands. Tungsten lamps and the production of suitable batteries made electric lighting a practical proposition, but these things, though good individually, were not a whole lighting system and sadly needed the perfecting of every detail entering into the complete equipment.

The Willard Storage Battery Company, of Cleveland, Ohio, has solved the problem of lamps becoming loose by reason of vibration and given a new impetus to electric lighting, by designing a socket in which the lamp does not depend on friction to hold it in position. This socket requires lamps fitted with Edi-Swan base. The pins on this style of base engage a bayonet catch on the socket, the lamp being firmly locked in place by substantial plungers which also carry current to the lamp.

For headlights a socket is used which slips into a sleeve at the apex of the parabolic reflector. The socket may be moved forward or backward for adjustment of focus and securely locked in place by means of a compression clamp. In side and tail lights a double-end socket is placed in a vertical position, one end carrying the lamp and the other engaging an attachment plug also fited with pins similar to those on the lamp base.

Manufacturers of tungsten lamps are also recognizing the advantages of the Edi-Swan base because in addition to staying in its socket, it is substantial presents more surface for cementing bulb to base and permits the use of larger leading-in wires in high candlepower lamps, than other bases.

ECONOMY SWITCH AND RECEPTACLE BOX.



VIEWS OF BAYONET-LOCK SOCKET.

VIEW OF SOCKET AND PLUG.

Adopts Electric Blasting System.

The Granite-Allie Company, Murray, Idaho, has recently adopted an electric blasting system in its mines.

The Determination of Capacity and Power of Davidson Ventilating Fans.

In the case of air movement the determination of volumetric capacity and the corresponding power expenditure of fans presents more or less difficulty. As the velocity and pressure are reduced this becomes increasingly so, principally because ordinary resistances and atmospheric disturbances have a proportionally greater influence as the produced velocity and pressure are reduced. For this reason the range of capacity and power of screw or propeller fans is subject to wide fluctuations according to the resistance presented by extended piping systems or wind velocity. The minimum power and the maximum delivery per cubic foot for a given number of revolutions is secured only when there is no opportunity for interference of air currents and the fan delivers freely in still air. It is under these conditions that the properties of Davidson ventilating fans as presented in the accompanying curves have been determined by the Massachusetts Fan Company, Watertown, Mass.

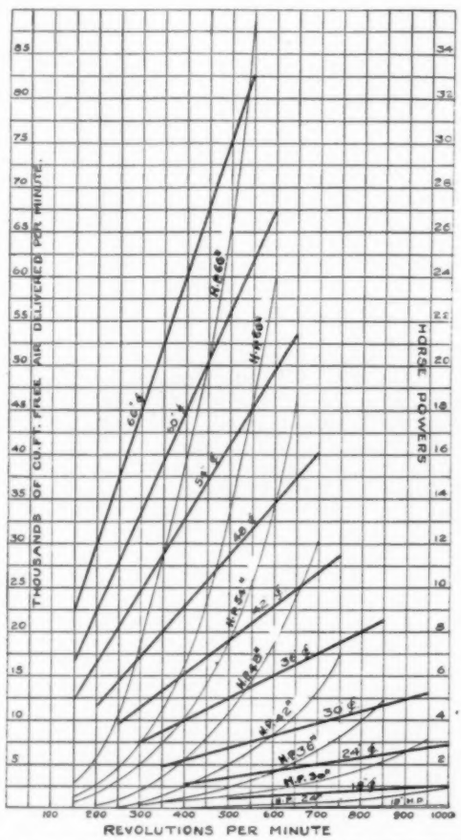
Machines for producing air movement naturally divide themselves into several groups, each proving most efficient within certain limits of air pressure produced. When velocities and resistances are low the screw or propeller type best serves the purpose. Here the air is both received and discharged in an axial direction. For pressures ranging from somewhat less than one ounce per square inch up to a possible twelve to sixteen ounces the peripheral type occupies the field. In this the air is received axially but delivered radially around the periphery usually into a spirally expanding case with suitable outlet.

Beginning within the range of ten to twelve ounces the rotary blower, moving forward uniformly measured volumes of air, possesses the ability to create pressures ranging up to several pounds per square inch. The turbine blower, now in process of development, covers much the same field. For the production of still higher pressures the piston blowing engine and the air compressor successfully meet the requirements.

The effect of increased resistance through the extension of piping or the counter blowing of the wind is to throttle the discharge, thereby decreasing it, but at the same time increasing the power required to drive the fan. This is exactly opposite to the effect of resistance in the case of the peripheral discharge; here increase in resistance, which is equivalent to reduction in free delivery area, decreases the work to be done and hence the power required. But even when the outlet is entirely closed considerable power will be required to drive the fan within the case.

With the propeller fan on the other hand the decrease of resistance to free discharge increases the power required until the maximum must be expended when there is no air whatsoever discharged.

In other words, in a peripheral fan the power is automatically adjusted, although only approximately, to the work actually accomplished in moving air, while the propeller fan becomes increasingly inefficient as the delivered volume diminishes. Hence it is far more vital in the case of the latter type that resistance should be reduced to a minimum.



CAPACITY AND POWER CURVE FOR DAVIDSON VENTILATING FAN.

Proposed State Railroad in Oklahoma.

State ownership of a system of interurban railway lines to compete with the steam railroad is proposed in petitions which are being circulated in Oklahoma.

It is proposed that the right of the state to own and operate lines shall be incorporated in the constiution. Provisions are made for the creation of a state board of railway construction and transportation, and that all employes shall work under a civil service system.

It is further proposed that all control of the railroads be put up to the state board and the question removed from politics and legislative control. Special attention is to be paid to the question of the feasibility of hauling children to the rural schools free of charge, whenever practicable.

New Long-Distance Lines in Russia.

The Riga Telephone Company, of Riga, Russia, plans to establish long-distance lines 100 miles to Pernau, 160 miles to Riga-Dorpath, and 142 miles to Riga-Fellin.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JULY 1.—An important decision has been given this week in the Law Courts on the question of municipal trading in the wiring and fitting of consumers' premises. The general construction put upon the electric lighting acts in the past has been that no municipal electric supply authority has power to do this except by special consent of Parliament, and it was in consequence of this view being commonly held that quite a number of municipalities obtained special Parliamentary powers. In London, the County Council obtained the power on behalf of all the London borough councils. In Leicester, the municipality and the electricity undertakings have been controlled by one engineer, and he took the view that as the gas acts gave specific power to wire premises and hire out motors, so, by inference, did the electric lighting acts. The result was that the local wiring contractors took action to restrain the corporation from doing this, and the decision of the Chancery Court judge is that the Leicester corporation exceeded their power in trading in this manner, and ordered it to cease. The decision has caused no surprise, because the electric lighting acts clearly discriminate between supply and use, and electric supply undertakers have no authority to interfere in any way with the use of the electricity on the other side of the meter. The point was raised that "consumers' terminals" meant the consumers' lamps, but the judge pointed out that in this case, the supply authority would have to wire and fit all premises free of charge. There is some suggestion of the corporation appealing against the judge's decision, but it is not generally considered that there is much hope of success.

An interesting scheme was described to me a few days ago for the construction of a huge freight clearing house in London in which the human handling of the parcels will be reduced to a minimum, if not dispersed with altogether by the aid of electricity. Each floor of the clearing house will have a continuously moving platform in the basement. These electrically-driven platforms, placed side by side or a short distance from each other, have another moving platform surrounding the whole of them. This latter travels the faster. Something akin to flat-bottom boats is used for sending the goods about. Along the main platform are rollers inclined inwards, and when a boat of freight reaches, on the main platform, the spot where one of the slower platforms touches it, by a system of electric selective control, the rollers are set in motion and the boat is rolled off the main platform onto the slower platform according to the floor or bay required. The controller by which this process is performed is naturally a very intricate piece of mechanism. The British Westinghouse Company is interested in the electrical arrangements and Sir William Preece has reported favorably upon them.

Once again has an electrical project having great public advantages been killed by municipal conditions. For several years a scheme has been in the making for constructing an electric tube railway under the River Tyne from North Shields to South Shields. It was admittedly a necessary improvement and yet the promoters have found the municipalities absolutely unwilling to help them, either by way of finance or even to make the path of promotion easy. Before consent could be given a large deposit of money was asked, and further, the purchase of certain lands was a condition precedent. It is true the scheme has been suspended for several years, but a little co-operation on the part of the local authorities would probably have seen the line constructed ere this.

The costs of the transfer to the State of the National Telephone Company's undertaking, irrespective of the purchase price, are estimated at $500,000.

Committees are at work in the postoffice department in London investigating the effect of telephone exchange work upon the health of the operators. A few recommendations in the way of altering the hours of work and recreation, and some small improvements in the industry have already been made.

Very satisfactory profits are shown by the London County Council tramway systems for the year ending March 31. The gross surplus was nearly $4,000,000 and after making full provision for renewals, repayment of capital, etc., there is a balance of nearly $300,000, which is added to the general reserve.

At the annual meeting of the Marconi Wireless Telegraph Company this week it was announced that negotiations are being carried on with a large number of foreign governments (with the assistance of the British Foreign Office) for the development of wireless communication. A scheme has also been submitted to the British government for a further extension of long-distance transmission from Great Britain. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JUNE 28.—At La Rochelle, one of the principal sea ports on the Atlantic coast of France, measures are being taken to use electric motors quite extensively for carrying out the different operations of the port. Among the machines which are to be thus fitted out are capstans, drums, sluice gate lifting devices, pumping machines and air compressors. Overhead and underground wiring are included in the programme.

The extensive electro-metallurgical works which are located at Dives, on the channel coast of France, have decided to take up the production of tin, including manufactured products of this metal. Heretofore such material was obtained largely from foreign countries. The present firm is now engaged in erecting a factory which will be devoted to the purpose of tin production.

At Centinje, Montenegro, there is being developed a project for building a central station for public and private lighting, according to the plans of engineer Steiner. The buildings will no doubt be erected by the Pichler firm.

According to recent news about the electric railroad which is to be built between Vienna and Pressburg, the project has now been decided upon, at least for the most part. The line will start from the central part of Vienna and follow along the Donau canal as far as the city electric plant. From this point it can reach the terminus by two different routes, one of which is to be chosen, the first route being by way of Kaiser Ebersdorf, while the second follows the State Railroad to the locality of Simmeringer Kirche, and from thence reaches Pressburg.

Among recent projects in Austro-Hungary, I note that the Austrian Siemens-Schuckert firm is erecting a power line so as to supply the town of Bartelsdorf (Bohemia) with electric light from the Ober Georgental station. At Rzeszow, in Galicia, an electric plant is being erected which will use machines furnished by the Ganz firm. A hydraulic plant will soon be built for the supply of the town of Bockstein, and the municipality of Gossengrün is erecting a central station for the town lighting. Vienna is to have a new section of city tramway line, and it will start from the Gersthof railroad station.

In Sweden, there is to be built a hydraulic plant of considerable size upon the Porjus fall. The expense of the undertaking is estimated at 12,000,000 crowns.

A narrow-gauge electric railroad is to be built in the region of the Riesengebirge (Germany). It starts from the locality of Reibnitz and passes by way of Warmbronn and Brückenberg to the terminal point at Schmiedeberg. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., JULY 9.—The Sherbrooke Railway and Power Company, of Sherbrooke, Que., has completed the deed of sale conveying all the properties, water powers, etc., purchased by the company from the British American Land Company. The purchase price paid by the railway company was $75,000.

A strongly capitalized power combine of Peterboro, Ont., has bought the Healy Falls, Burleigh Falls and the Auburn Falls. A new concrete dam and power house will be built at Auburn. The same syndicate has acquired the Peterboro Light and Power Company's interests and also the Peterboro Radial Railway, and will build several miles of new street car tracks in the city and vicinity.

The little town of Fort Francis, Ont., apparently knows not defeat, for it is sticking to its anti-power export agitation with a heroic persistency. The latest development in the matter is an appeal to the Dominion railway commission here. In spite of the town's protests, both the Dominion and Ontario governments have allowed the Minnesota and Ontario Power Company to export a part of the electric power developed at Fort Francis to International Falls on the American side of the river.

It is announced that the Dominion government intends to rebuild the entire telephone line from Kamloops to Lower Nicola, in British Columbia, and contracts for the poles have already been awarded. There will be a good deal of telephone construction work done in the interior of the province, as soon as the money provided for the purpose is made available. These works include an extension of the North Thompson telephone lines, from Kamloops to Vernon, and the duplication of the line between Kelowna and Penticton, entailing the laying of two new cables across Okakagan Lake.

The contracts for the hydroelectric distributing station, for the town of Galt, Ont., have been let. The incandescent system

for street lighting, as adopted, together with the amount for poles and wires paid to the local electric company, will make the total cost to the town, for installing a service under hydroelectric auspices, only $25,000. The town declined to purchase the entire plant of the existing electric company, and thus saved a large amount which other municipalities have spent in buying out private equipment, most of which is found useless.

Particulars of the latest acquisition by the Mexican Power Company, that of the Irrigadora Company, have been given out. The Irrigadora Company has been carrying on a light and power business in the city of Pachucha and surrounding territory, sixty miles from the city of Mexico. The company's income, for 1910, is estimated at $335,000 gold gross, and net $260,000. The Mexican Power Company has bought the other concern for $3,700,000 gold, of which one-half has been paid in cash and the balance in six per cent first mortgage bonds. A branch transmission line to Pachucha will be run from Mexico, and the Pachucha plant shut down as soon as this is accomplished.

It is announced that arrangements have been completed between the Grand Falls Power Company, of St. John, New Brunswick, and Sir William Van Horne and other owners of property at Grand Falls, on the river St. John, by which the latter will take over the old company, and develop power at the falls. It is said that a new company will be organized under the federal law, and a large power plant erected at the falls. The development of the great power at the falls has been prevented for years by the struggle between rival interests, which are at last said to have reached an agreement, and the promotion of many large industries is now expected. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

TO DEVELOP MINES BY ELECTRICITY.—Within a few weeks the work on the Barker Meadow dam near Nederland, Col., will be completed and by September the plant will be ready to supply power to the tungsten mining district. There are at present four tungsten mills in this district and two more are now in the course of construction. The dam, which is across Boulder Creek, will be 180 feet in height, 300 feet in length and 140 feet thick at the base; backing up a lake about 350 acres in area. It is estimated that 25,000 horsepower will be generated by the plant when complete.

A BIG CANADIAN POWER PLANT.—Work upon the establishment of what will be the largest and most expensive power plant in Canada will soon be started by the British Columbia Electric Railway Company, in the Chilliwack district, the necessary rights having been granted by the Dominion government. The work will involve an expenditure of $10,000,000 and the plant will produce over 110,000 horsepower of electrical energy. The site of the proposed plant is on a 100-acre tract, a short distance northeast of the Popkum Indian Reserve, and the sources of power to be tapped are the reservoirs formed by Jones Lake, east of Chilliwack, eighteen miles, and Chilliwack Lake, twenty-three miles southeast of that city. The streams flowing from both these sources will be diverted by means of enormous hydraulic tunnels and carried to a common point where the power plant is to be established. Engineers are now at work in the Jones Lake district. It is estimated that it will take two and one-half years to complete the work. The tunnel from Jones Lake is to be 10,200 feet long, and will pass under a mountain near Mount Cheam, which is 7,000 feet high. The tunnel from Chilliwack Lake is to be 14 by 16 feet in size and five and one-fourth miles long. It is expected that this latter work will be completed within five years.

LIGHTING AND POWER.

(Special Correspondence.)

TIPTON, MO.—This city has voted electric light bonds to the value of $17,500. P.

COLEMAN, TEX.—This city has voted a bond issue of $20,000 for electric light purposes. P.

AURORA, MINN.—Bonds for $10,000 have been voted for the erection of an electric light plant. C.

BIWABIK, MINN.—It has been voted to issue bonds for the construction of an electric light plant. C.

WHITECASTLE, LA.—The Dunlap Electric Light Company, of Plaquemine, has been granted a franchise here. P.

BLACK RIVER FALLS, WIS.—Work has been started on the construction of the municipal electric light and power plant. C.

ELLENSBERG, WASH.—The Electric Power Company has been incorporated by J. C. Donnelly, H. J. Manny and others of Tacoma, Wash.

GRANGEVILLE, IDA.—The Big Bend Electric Light and Power Company has purchased the plant of the Grangeville Light and Power Company. P.

NORTH SALEM, MASS.—Electric lights were turned on in this city a short time ago, and for the first time this city is illuminated by electricity.

LA BARRANCA, MEX.—The Sunset Mining Company is planning to install a power plant here to supply power to the surrounding towns and hamlets.

SAN FRANCISCO, CAL.—The Sunset Power Company has been incorporated by C. B. Greeley, W. L. Boos and Thos. Turner, with a capital stock of $500,000.

MARSHALLTOWN, IOWA.—The Marshalltown Club is arranging for the installation of sixty electroliers on Main Street, and will shortly let the contract for them. C.

ROBBINSDALE, MINN.—An ordinance has been passed granting a franchise to the Minneapolis General Electric Company to furnish light, power and heat by electricity. C.

HUNTSVILLE, TEX.—The Huntsville Electric Light Company has installed a new gas engine and gas producing plant. The new service will be far superior to any heretofore enjoyed.

AURORA, MINN.—The village council let the contract to the Marshall-Wells Hardware Company, of Duluth, Minn., to install the electrical equipment at the lighting plant for $2,300. C.

INGERSOLL, ONT.—The Corporation recently took over the plant of the Ingersoll Electric Power and Light Company and the work of making necessary changes was commenced at once.

HARRISBURG, ARK.—The Harrisburg electric light plant has been leased by George and O. P. Winters for a period of five years. The new lease holders propose to improve the property in many ways.

OAKLAND, CAL.—The Richmond Light and Power Company has applied to the Superior Court for dissolution. The directors are Evan Williams, J. S. Lamson, A. L. and Harry Chickering and Winfield Dorn. A.

SAN FRANCISCO, CAL.—The Mutual Electric Light Company has been awarded the contract for furnishing current for electric light and other purposes in the Ferry Depot and along the waterfront for the next three years. A.

MARION, IND.—Wilcutts & Hoover of this city have been awarded a contract for the construction of a concrete dam across Elkhart River at Syracuse, Ind., for the purpose of supplying current for electric light and power. S.

PORTLAND, ME.—The Brunswick Power Company has been incorporated with a capital stock of $750,000 to do a lighting and power business. The president is C. Southworth and the treasurer A. S. Bosworth, both of Portland.

JEFFERSON CITY, MO.—The Nevada Water, Light and Traction Company of Nevada has been incorporated with a capital of $350,000. The incorporators are Henry C. Parker, William W. Siebert, Edward Willard and others.

KLAMATH FALLS, ORE.—J. Lewis and G. McDonald will commence work this summer on a power plant to be built on Deep Creek, about twenty-two miles east of Lakeview. It is estimated that 7,000 horsepower can be developed.

BIRMINGHAM, ALA.—The Birmingham Rail and Locomotive Company just placed order through Haskins Williams, president, for $25,000 in electrical machinery. The new plant, which will cost about $150,000, will be in operation in August. B.

CAMDEN, N. J.—The Stone Harbor Electric Light and Power Company has been incorporated with a capital of $100,000, to operate electric lighting and power plants. The incorporators are Howard S. Risley, David Risley and Reese P. Risley.

PRINCETON, IND.—The Princeton Light and Power Company has increased its capital stock to $100,000. The purpose of the company is to make extensive improvements and extensions. Henry C. Barr is president and Jno. M. Barrett, secretary. S.

SHELBYVILLE, IND.—William H. Jones, manager of the Citizens Water and Light Company for a number of years, has resigned. The plant changed hands a few weeks ago, the property having been sold to the Central Indiana Lighting Company. S.

WAYCROSS, GA.—The reinforced concrete powerhouse of the Ware County Electric Light Company, is about completed. The company recently issued $320,000 bonds. Thirty-five thousand dollars worth of the bonds will be used for the purchase of new equipment.

REDDING, CAL.—The Sierra Nevada Power and Irrigation Company has commenced suit against the Central Pacific Power Company to secure certain rights of way and condemn certain pieces of land on Montgomery Creek, Hatchet Creek and Roaring Creek.

BONESTEEL, S. D.—Following a visit to the city and an inspection of local conditions, E. A. Bullock, a capitalist of Norfolk, Neb., decided to apply to the city council for a franchise for an electric light plant. The system will be installed at the earliest possible date.

COLUMBUS, IND.——The Central Indiana Lighting Company has put its new power house in operation. The machinery in the old Crump power house which has furnished electric power for the Columbus street cars for twenty-five years is being removed to the new plant. S.

CENTRALIA, WASH.—The Twin City Light and Traction Company has let a contract for a $150,000 power plant to be located at Coal Creek about four miles southeast of Centralia, to supply

current for Chehalis and Centralia. The plant will be completed within three months. A,

STAUNTON, VA.—At a Common Council meeting held recently a resolution was adopted calling for closing down the municipal plant and at the same time awarding the contract for lighting the city to the Staunton Lighting Company. This company will light the streets for $6,000 per year.

SPARTANSBURG, S. C.—The Shores-Irwin Electric Company has secured the contract of installing the electric light plant for the hotel being built at Alta Pass by the Green River Land Company. It is probable that the Shores-Irwin Company will also light the town of Alta Pass from the same plant.

MANITOU, COL.—The old arc lights which were in use here have been replaced by eighty-candlepower tungsten lamps. In addition a large number of smaller circuits have been arranged in the Soda Springs park and various other parts of the city. It is intended to use these lights largely for ornamental purposes.

BUFFALO, N. Y.—The electric-light plant which was ordered installed in the City and County Hall by the trustees of that building has been completed. The total appropriation for the installation of the lighting plant was $74,296.12, city and county appropriating each $37,148.06. The plant was designed and installed by J. J. O'Leary.

MACON, GA.—Business men are organizing the Cherry Street White Way Company, for the purpose of systematic and complete electric illumination of that street. Lamp fixtures, etc., will be bought. Plans of J. E. Rood, specialist, were adopted. Joseph N. Neal is president and F. H. Hyman, secretary and treasurer of the new company. B.

MARINETTE, WIS.—Work at the power plant of the Northern Hydro-Electric Company at High Falls is now confined to the interior of the power house. The concrete dam has been completed and the power house finished, and the machinery is now being installed in that building. All of the machinery is on the ground ready to be erected.

BERKELEY, CAL.—The Berkeley Gas, Light and Power Company was granted the contract to furnish the city electric light and power for the ensuing fiscal year through the adoption of an ordinance. By the provision of the instrument the company will be required to reduce the voltage of the lights furnished the city from 220 to 110 volts.

READING, PA.—All of the wires in the downtown district of this city are being placed underground by the Metropolitan Electric Company. The improvement will be one of the most important undertaken by the Metropolitan company in many years. It will require considerable time to accomplish, but the intention is to carry it along gradually until the task is completed.

WEBSTER, MASS.—The Webster & Southbridge Gas & Electric Company has recently ordered another steam-turbo alternator from Allis-Chalmers Company. This is a 1,000-kilowatt, three-phase, sixty-cycle, 2,300-volt machine and will operate in parallel with the present 500-kilowatt machine. It will care for the largely increased load which has recently been secured.

SACRAMENTO, CAL.—Articles of incorporation of the Sacramento Valley Power Company have been filed in the County Clerk's office. The company owns water rights and a power plant on the Feather River, in Shasta County. With the articles of incorporation is a deed of trust to the Central Trust Company as guarantee for a bond issue of $500,000 for development purposes. The incorporators are Paul C. Morf, Henry C. McPike, Lewis I. Haven, John J. Dailey and James F. McCue.

ATLANTA, GA.—A franchise for fifty years has been granted to the Georgia Power Company by the Atlanta city council July 6. The company purchased the North Georgia Electric Company when sold by receiver. The power plant is located at Gainesville, Ga., and wires are strung up to Atlanta city limits. Officers: C. Elmer Smith, York, Pa., president; S. P. Dobbins, New York, secretary; L. F. Joerissen, Atlanta, treasurer. The capital stock is $6,000,000, and bonds for the same amount have been issued. B.

ATLANTA, GA.—On July 7, Judge W. T. Newman of the United States Court confirmed the sale of the properties of the Etowah Power Company, which has extensive holdings along the Etowah River in Cherokee and Bartow counties. The purchaser was S. Fahs Smith of S. Morgan Smith Company, York, Pa., and the purchase price was $160,000. A short time ago Mr. Smith also bought for $100,000 the property of the North Georgia Electric Company of Gainesville and Atlanta, Ga. B.

LANSING, MICH.—Representatives of the Bay City Power Company have appeared before the state railroad commission with a petition for permission to issue first mortgage five per cent twenty-five-year gold bonds to the extent of $500,000 in order to liquidate the outstanding obligations of the corporation, which, according to the officials, amount to $439,000. In the petition there is a provision that the company shall for each $10,000 worth of bonds issued, take up and cancel not less than $9,000 of such obligations.

DUNSMUIR, CAL.—The Siskiyou Power and Light Company has acquired all the electrical holdings of the Mossbrae Falls Light and Power Company, and hereafter will be the sole occupant of this field. The purchase was effected on June 15, but the matter was kept from the public in order to enable the purchasers to perfect arrangements for connecting up the old system with the new. The Mossbrae power plant will be abandoned, the new company having abundant power of its own, and the poles and wire of the old company will be taken down.

SALINA, U.—A company headed by John Monson, Hugh Lisonbee and Milan Packard has acquired the Salina electric power plant and took possession July 15. It has secured a new power site at Rattlesnake hill four miles further up the Salina canyon than where the present plant is located. This will be developed before the first of the year and the machinery from the present plant will be moved to the new site, and an additional generator will be installed. The company propoes to extend its operations to towns lying near Salina.

PORT AMBOY, N. J.—The East Jersey Light and Power Company, in which William J. Lansley, of this city, is interested, has been incorporated and started business. The intention of the company, which is backed by New England capital, is to acquire a number of electric light companies in central New Jersey. It is capitalized at $1,500,000 and is authorized to not only do a lighting and power business, but also to purchase, hold and sell stocks and bonds of other electric light companies. The directors of the new company are: A. W. Bailey, Andrew Foulds, Jr., and Chas. E. Robertson.

FAIRBAULT, MINN.—The Consumers Powers Company has installed and placed in operation in this city an ornamental curb lighting system covering eleven blocks in the business district. When H. M. Byllesby & Company of Chicago, purchased the gas and electric properties at Fairbault, a contract was made with the city for the installation, operation and maintenance of the ornamental lighting. There are 106 standards, each bearing three forty-watt tungsten lamps. All three lamps burn from dusk to midnight and one lamp all night. Citizens of Faribault are said to be very well pleased with the installation and its illuminating effect.

PRINEVILLE, ORE.—A company of Prineville capitalists have filed articles of incorporation with the county clerk here for the Cove Power Company. The purposes as set forth in the articles of incorporation are the generation of electric and water power etc. The main office of the corporation will be located at Prineville. The capital stock is fixed at $50,000 and is divided into 500 shares of equal value; the majority of the stock will be taken by Prineville capital. The officers of the corporation are W. A. Booth, president; Warren Brown, secretary- treasurer. The power site is near the Cove orchard, opposite Culver postoffice on Crooked River. The plant will develop 9000 horsepower.

GALENA, ILL.—H. M. Byllesby & Company, of Chicago, has purchased the electric generating and distributing properties owned by the Interstate Light and Power Company, with headquarters in this city. This property serves the electrical needs of a territory 200 square miles in area in the lead and zinc-mining fields of southwestern Wisconsin and northwestern Illinois. Power is produced at a modern steam-generating station near Galena. All electric energy used in Galena, Ill., and Platteville, Cuba City, Benton and Hazel Green, Wis., is supplied by the Interstate company. These cities and towns comprise a population of 18,000. Power business received from the lead and zinc mines has created a large day load. Byllesby & Company propose to make additions and improvements.

HARRISBURG, PA.—A $3,000,000 deal concluded here recently resulted in the consolidation of two large public service corporations that had been rivals for six years, and marked the beginning of a movement for the purchase of other large corporations and their consolidation. Emmet Queen, of Pittsburg, engineered the deal, he purchasing the Harrisburg Heat, Light and Power Company and the Paxtang Electric Company, also of Harrisburg. The price paid was $3,000,000. It is the intention to consolidate the Harrisburg companies with the Citizens Heat, Light and Power Company, of Johnstown, Pa., which was acquired recently by Mr. Queen. The Johnstown concern consists of all electric light and gas plants in the Flood City, the combined capital being $4,500,000. Other electric light and gas plants in Pennsylvania will be included in the consolidation.

AUGUSTA, ME.—The Pacific Power and Light Company has filed articles of incorporation with secretary of state in Maine. The company has an authorized capitalization of $7,500,000, of which nothing is paid in, and will deal in machinery, generators, motors, and appliances for the distribution of electricity. The promoters include A. E. Smith of Montclair, N. J.; E. W. Hill, New Rochelle, N. Y.; H. D. Squier, William R. Reiser, R. J. McClelland, F. S. Baker, E. J. Roohn, G. J. Anderson and R. U. Fting, all of New York; E. P. Summerson, O. R. McMahon, A. C. Dixon and E. W. Freeman, all of Brooklyn; C. M. Hamilton, Elizabeth, N. J.; and James G. Campbell, Newark, N. J. Miss E. M. Leavitt, a clerk in the law office in which the company was organized, was named as president and treasurer. The capital stock was given a par value of $100 a share, $6,000,000 being common and $1,500,000 preferred stock.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MISSOULA, MONT.—The local street car company, of which S. L. Inch is manager, will construct a line to Fort Missoula. C.

POMONA, CAL.—G. E. Pillsbury has been granted a franchise to operate and maintain for thirty years, an electric road in the streets of Pomona.

VENICE, CAL.—President Gillis of the Los Angeles Pacific Railroad has been given authority to four-track the electric line between Venice and Redondo.

VANCOUVER, B. C.—The Vancouver, Camas and Washougal Traction Company has been incorporated by H. C. Phillips and others with a capital stock of $100,000.

IRONWOOD, MICH.—A franchise has been granted to Albert D. Johnston, Florence D. Sullivan, Arthur F. Appleyard and Manuel M. Reid for the construction of a street railway. C.

LINCOLN, ILL.—The work of grading on the new Springfield and Jacksonville interurban is progressing satisfactorily and the work has the hearty co-operation of the people along the line.

ABERDEEN, S. D.—The Aberdeen Street Car Company let the contract to the General Electric Company for two motor generator sets, with the proper switchboard controlling devices. C.

SUPERIOR, WIS.—According to L. N. Loomis, president of the Twin City and Lake Superior Electric road, a third-rail electric line will be in operation between the Twin Cities and the head of the lakes within a year. C.

INDIANAPOLIS, IND.—The second trade extension trip by the Indianapolis Trade Association was run over the Indianapolis & Cincinnati Traction line July 15. Fourteen towns and cities were visited during the one-day trip. S.

ATLANTA, GA.—The Fairburn & Atlanta Railway and Electric Company, of which L. W. Roberts, Fairburn, Ga., is chief engineer, will soon begin track laying on grading which is practically completed for the entire twenty miles. B.

AUBURN JUNCTION, IND.—The Indiana Railroad Commission has ordered a complete and modern interlocking system installed at this point where three steam and two traction lines cross each other with double tracks in some cases. S.

EVANSVILLE, IND.—The Evansville & Southern Indiana Traction Company has entered upon the work of ballasting the road north of Patokas. The gravel and broken stone used for ballast is distributed by steam road dump cars hauled by motor cars. S.

MARTINEZ, CAL.—A. W. Maltby, of the Oakland-Antioch Railway Company, has applied for a franchise for an electric road from Martinez to Oakland, passing through the inter-county tunnel and through Lafayette, Walnut Creek and Concord, a distance of twenty miles.

ATLANTA, GA.—The Georgia Railway and Electric Company is relaying and improving its tracks to Decatur from East Lake Junction, and will put on through interurban cars from Atlanta to Decatur, removing the former necessity of transferring at the junction. L.

CAMDEN, MASS.—The Stone Harbor Electric Light and Power Company of Camden, has been incorporated under the laws of New Jersey to operate electric light, heating and power plants. The capital is $100,000, and the incorporators are Howard S. Risley, David Risley and Reese P. Risley.

ATLANTA, GA.—The report of the comptroller general of Georgia for 1909, recently issued, shows that street railway companies paid $63,875 state taxes, $82,186 county taxes, $119,375 city taxes, and $4,688 district school taxes. Corporations paid a total of $879,674 county taxes, $468,472 city taxes, and $59,740 for school taxes. L.

COLORADO SPRINGS, COLO.—The Colorado Springs Electric, Colorado Springs Light and Power and the Pike's Peak Hydroelectric companies were recently merged into the Colorado Springs Light, Heat and Power Company. Greater efficiency in service and economy of administration are given as the reasons for consolidation.

SOUTH BEND, IND.—The Elkhart & Bristol interurban road, an extension of the Chicago, South Bend & Northern railway system, owned by the Murdocks of Lafayette, was placed in operation recently. The trial trips attracted considerable attention and the road received a hearty welcome. It is the intention of the company to extend the line as far north as Kalamazoo, Mich. S.

FT. WAYNE, IND.—The city council of Columbia City has granted a franchise to the Ft. Wayne & Winona interurban line projected by J. A. Barry and associates. Petitions are also pending in several other cities which the proposed road will run when completed. There seems to be a general desire for the road and Mr. Barry says there is no doubt about its construction.

ENSLEY, ALA.—A meeting held July 7 for the purpose of building new and independent trolley line, Owenton to Shady Side. Tom O. Smith, of the Birmingham Trust and Saving Bank, and Frank Nelson Jr., representing Steiner Bros., bankers, T. B. Bush estate and a number of others were present. An engineer was employed to make a survey of the line, which, it is reported, will cost $1,250,000. B.

AMERICUS, GA.—It is reported that Mr. Rood, of Springfield, Mass., formerly president Hamilton Watch Company, will guarantee the building of an electric light plant and establishment of an electric-railway system here if city will grant necessary franchise and renew contract made several years ago, but which was not carried out by parties to whom the franchise was at that time granted. B.

MEMPHIS, TENN.—The Yazoo & Mississippi Valley Railroad Company is to establish a suburban passenger service as far south as Lake View, Miss. This is the southern terminus of the Lake View Traction Company, which is building a line from Memphis to Lake View. This move of the Yazoo & Mississippi Valley Company is to be made to compete with the Lake View Traction Company.

INDIANAPOLIS, IND.—The city council has amended the franchise granted by the board of public works to the Beech Grove Traction Company so as to make it expire in 1933, when all the other city and interurban franchises expire. It also provides that the road shall be completed and in operation within a year and that the franchise shall not be transferred without consent of the city council. S.

PLYMOUTH, IND.—The last bridge on the grade of the new electric line being built by the South Bend and Logansport Traction Company has been completed and the grade work is progressing rapidly. The officials say the rails will be laid within a few weeks and the road will be in operation by October 13. When this road is completed there will be two trolley routes from South Bend to Indianapolis. S.

LEESBURG, VA.—The Washington-Virginia Railway Company, an electric line, has been granted a charter by the state of Virginia, to operate an electric line from Vienna, Fairfax County, to Bluemont, Loudon County, fifty miles distant. The company has an authorized capital of $1,000,000. The president is M. E. Church, of Falls Church, and the treasurer is L. L. Northrop. The proposed line will pass through several towns which are of considerable size. L.

DALTON, GA.—The proposed electric line from Chattanooga, Tenn., to Dalton, Ga., is taking more definite shape, and preliminaries are being worked out as rapidly as conditions admit. This line contemplates a direct connection between the two above-named cities, and the promoters will visit Dalton the middle of July, to investigate conditions, and look into a proposed extension to Chatworth, connecting with the Louisville and Nashville Railway. L.

TOLEDO, OHIO.—A new electric line nine miles long is being projected in Toledo. It will start at the end of the Ottawa Park line, pass out Auburn avenue to Bancroft, to Angling road, to Talmadge avenue to Monroe street. The road will be private property and the company will be owned and operated by property owners of that section. P. S. Willis is now engaged in securing the right of way. H. C. Adams, a local attorney, is forwarding the plan. H.

ANDERSON, IND.—The first interurban car built in Indiana was placed in service by the Indiana Union Traction Company July 8. The car was built at the Anderson shops and is novel in many respects. It has an auxiliary system which practically insures freedom of brake trouble. This is a feature new to both steam and electric roads. The seating arrangement is new and the seats are larger and more comfortable than on the old cars. The car is beautifully upholstered and elegant in design.

INDIANAPOLIS, IND.—Judge Vincent Carter of the Superior Court has agreed to consider a petition to be filed by C. L. Henry, receiver for the Indianapolis & Cincinnati Traction Company, for the appointment of a commission to sell the property of the corporation. The bondholders of the $2,000,000 of outstanding honds have signed an agreement for the sale and reorganization of the company. As soon as the reorganization is completed the road will be extended into Ohio in order to get connection with Cincinnati. S.

CHARLOTTE, N. C.—No official action has as yet been taken upon the application of Paul Chatham for an electric street railway franchise here, the application being opposed by the Charlotte Electric Street Railway Company. The franchise, however, will probably be granted, giving the applicants the right to use one street as an outlet from the town, and to parallel the tracks of the existing company for a not greater distance than 1400 feet consecutively. It is believed the Southern Power Company is interested in this application, or will be later, seeking interurban facilities. L.

GASTONIA, N. C.—The city council has granted the application of the Isothermal Traction Company for a franchise through the streets of Gastonia. This company proposes to build an interurban electric line that will ultimately reach the city of Asheville, ninety miles distant. The council has also granted an extension of one year to the Piedmont Traction Company in which to begin work, the original franchise providing that work should begin by January, 1910. Under the new agreement the traction company is to begin work by January, 1911, and complete the system or have cars in operation by July, 1911, and is not to use steam power, and promises the town a reasonable service. L.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

CORDELE, GA.—Several farmers' lines being organized here to connect with Bell system. B.

MARYSVILLE, CAL.—The new system of the telephone company was put into operation recently.

NICHOLS, GA.—The Nichols Telephone Company has been incorporated with a capital stock of $2,000, by W. R. Frier and others. B.

WILLMAR, MINN.—An ordinance has been passed by the city authorizing the construction of a local telephone exchange at a cost of $35,000. C.

BRUNSWICK, GA.—The Southern Bell Telephone and Telegraph Company will establish telephone service on St. Simons Island, laying a cable from city to island. B.

BUFFALO, N. Y.—Papers of incorporation have been filed in the county clerk's office by the Colden-West Falls Telephone Company. The capitalization is placed at $7,500.

PIERRE, S. D.—The state capitol commission let the contract to the Dakota Central Telephone Company for the installation of an automatic telephone system in the capitol for $2,660. C.

SAN FRANCISCO, CAL.—The Bay Cities Telephone Company has been incorporated by Jas. Lanagan, E. C. McDonough, J. E. O'Brien, N. J. Prendergast, J. H. Manor and J. B. Young, with a capital stock of $20,000.

DULUTH, MINN.—The Tri-State Telephone Company has commenced work on the erection of a one-story, brick and stone, fireproof exchange building, 50 by 100 feet, at 115 North Twenty-third Avenue, to cost $30,000. C.

SAN FRANCISCO, CAL.—The Pacific Telephone and Telegraph Company has leased the property on the northeast corner of Mariposa and Harrison streets. The land has an area of 22 by 124 feet and has been leased for a term of five years at a total rental of $18,000.

BOONEVILLE, MISS.—Suit against the Cumberland Telephone and Telegraph Company for $1,500,000 has been filed in the Circuit Court by W. P. Shinault, special attorney for the state of Mississippi. The charges are for violation of the state anti-trust law and discriminating against subscribers.

AURORA, N. Y.—Articles of incorporation have been filed by the Colden-West Falls Telephone Company, capitalized at $1,500, to build lines in the two villages named and in the towns of Aurora, Colden, Hamburg and Boston. The incorporators are: George Koerner, C. N. Darbee, George C. Snashell, L. E. Eaton, Fred Hey, C. S. Rich and J. G. Sigler.

SEYMOUR, IND.—Articles of incorporation have been filed by the Four Corner Mutual Telephone Company. The capital stock is placed at $4,000. The object and purpose of the company is to acquire franchises, permits, etc., and to construct, equip and operate a telephone system or systems in throughout Jackson and adjoining counties. The principal office will be at the home of the secretary, O. M. Downs, R. R. No. 6. S.

FLORENCE, S. C.—The Bell Telephone people give a list of some very extensive construction work that they are to do through this county in the near future. The Bell people are pressing for a system all through the county. The line from Timmonsville now serves a number of farmers all through that section, and the toll lines from Cowards are being extended to Hannah, Hyman and other important centers in the lower part of the county removed from the rail and telegraph.

TACOMA, WASH.—An application has been made to the county commissioners by the DeLape Tours Company of Tacoma for the right to construct a telegraph and telephone line on the county road from Ashford to the national reserve on Mount Tacoma. The Pacific States Telegraph and Telephone Company will extend its line from Elbe to Ashford, while the government line in the reserve carries the line to Longmire Springs. The county commissioners ordered a hearing on the petition, the date of which will be fixed later.

ELECTRICAL SECURITIES.

There has been a more confident feeling of a general increase in values during the past week, than for some time previous. The force of the bear campaign seems to be spent. Until recently the strongest factor in the depression was that the newly acquired power of the interstate commerce commission would be used to prevent justifiable advances of rates by the railways. This has now been largely dissipated by the commission's action increasing rates on grain between Chicago and Buffalo, with the intimation that increased cost of operation should be considered in adjusting freight charges. President Taft's declaration that the railways must have fair play, also did much to restore confidence. Indications that pig iron has reached bottom prices, together with optimistic statements by Judge Gary and Mr. Schwab, encourage belief that a turn for the better has come in the steel industry.

In order to provide funds for the cash distribution in settlement of litigation against the company, as holder of the majority stock of the Metropolitan Securities Company, the Interborough-Metropolitan Company has sold $4,000,000 five-year six per cent notes at par.

The Westinghouse Electric and Manufacturing Company has closed negotiations with Kuhn, Loeb & Company for the renewal for three years from August 1 at six per cent a year of $4,000,000 of that company's outstanding $6,000,000 secured notes. The remaining $2,000,000 will be paid off from the company's surplus treasury funds. The new issue of $4,000,000 will be secured by all the bonds and shares now pledged as security for the $6,000,000 issue. The new notes will be redeemable at the option of the company upon any interest date on thirty days notice at 102 and interest. The notes are exempt from tax in the State of Pennsylvania.

DIVIDENDS.

American Gas and Electric Company, an initial quarterly dividend of one per cent on the common stock, payable July 12 to stockholders of record July 5.

American Light and Traction Company, regular quarterly cash dividend of two and one-half per cent and the regular quarterly stock dividend of two and one-half per cent on the common stock; also the regular quarterly dividend of one and one-half per cent on the preferred. The cash dividends payable August 1 to stock of record July 16; the stock dividend payable August 15 to stock of record July 16.

Brooklyn City Railroad; a quarterly dividend of two per cent, payable July 15. Heretofore the company has paid guaranteed dividends of ten per cent per annum.

Electric Company of America; semi-annual dividend of three and one-half per cent, payable August 3.

Lewiston, Augusta & Waterville Railway Company; an initial dividend of one and one-half per cent on the preferred stock, payable August 1, to stockholders of record July 15.

Lowell Electric Light Corporation; quarterly dividend of $2 per share, payable August 1.

Minneapolis General Electric Company; a quarterly dividend of one and three-quarters per cent on its common stock, an increase of one-quarter of one per cent over the last previous dividend; also the regular semi-annual dividend of three per cent on its preferred stock. The dividends are payable August 1 to holders of record July 15.

Railway and Light Securities Company; semi-annual dividends of three per cent on the preferred and two per cent on the common stocks, payable August 1 to stock of record July 16.

Union Traction of Indiana; common dividend of one per cent, payable July 9.

United Traction Company; the regular semi-annual dividend of two and one-half per cent on the preferred stock, payable July 15 to stock of record July 9.

NEW YORK.

	July 11.	July 4.
Allis-Chalmers common	8½	8½
Allis-Chalmers preferred	29	27
Amalgamated Copper	60	60⅝
American Tel. & Cable	*80	*80
American Tel. & Tel.	132½	132¼
Brooklyn Rapid Transit	75½	74⅛
General Electric	141	140
Interborough-Metropolitan common	18¼	17¾
Interborough-Metropolitan preferred	50½	51
Kings County Electric	124	124
Mackay Companies (Postal Telegraph and Cables) common	84	85½
Mackay Companies (Postal Telegraph and Cables) preferred	73	73
Manhattan Elevated	125¼	125
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
U. S. Steel common	70⅝	72
U. S. Steel preferred	114½	115
Western Union	60½	61
Westinghouse common	60	60
Westinghouse preferred	125	125

* Last price quoted.

BOSTON.

	July 11.	July 4.
American Tel. & Tel.	132½	132¼
Edison Elec. Illuminating	250	250
General Electric	141	140
Massachusetts Electric common	15	14¾
Massachusetts Electric preferred	77	75
New England Telephone	134	133
Western Tel. & Tel. common	15	15
Western Tel. & Tel. preferred	85	84

PHILADELPHIA.

	July 11.	July 4.
American Railways	42	43
Electric Company of America	11⅝	11½
Electric Storage Battery common	49	48½
Electric Storage Battery preferred	49	48½
Philadelphia Electric	14⅝	14⅝
Philadelphia Rapid Transit	19¼	18½
Philadelphia Traction	84	84½
Union Traction	45½	44½

CHICAGO.

	July 11.	July 4.
Chicago Railways, Series 1	65	70
Chicago Railways, Series 2	15½	16¼
Chicago Subway	2	2
Chicago Telephone	117	116½
Commonwealth Edison	110	112½
Metropolitan Elevated common	18	22
Metropolitan Elevated preferred	60	60½
National Carbon common	116	116
National Carbon preferred	118	118

PERSONAL MENTION.

SIR OLIVER LODGE has received the honorary degree of Doctor of Science from Cambridge University, England.

L. P. FEUSTMAN, vice-president of the International Steam Pump Company, has sailed for Europe to be gone probably until September.

E. J. HALL, vice-president of the American Telephone and Telegraph Company, New York, left last week on a two months' vacation in Europe.

PROF. JOS. W. RICHARDS, of Lehigh University, has just returned from the International Mining and Metallurgical Congress in Düsseldorf, Germany.

PROF. HENRY S. CARHART delivered an address on "The Twentieth Century Engineer" at the dedication of Passadena Hall of the Throop Polytechnic Institute.

CHAS. G. STURTEVANT resigned as secretary of the water and light board of Detroit, Minn., and is succeeded by Elmer J. Bestick, for many years employed in the Merchants National Bank.

CHAS. A. ROLFE, formerly of New York, now in charge of the Southwestern Home Telephone Company, of Redlands, Cal., was a recent visitor to the East, and reports a rapid growth in telephone service in his territory.

NELSON P. LEWIS, chief engineer of the board of estimate and apportionment, New York City, delivered the annual commencement address at the Clarkson School of Technology, Potsdam, N. Y. His subject was "The Engineer as a Professional Man."

F. H. CROCKARD, general manager of the Tennessee Coal, Iron and Railroad Company, delivered the dedicatory address at the recent opening of the engineering building of the University of Alabama. The building dedicated is to be known as Comer Hall.

M. DE CHATELAIN, professor in the Polytechnic Institute of St. Petersburg and president of the Electrolytic Section of the Imperial Technical Society of Russia, has come to America in order to study methods of utilizing water powers for the generation of electricity. He attended the meetings of the American Institute of Chemical Engineers at Niagara Falls and of the American Institute of Electrical Engineers at Jefferson, N. H.

PAUL R. ATKINSON, treasurer of the Edison Electric Illuminating Company of Brooklyn was badly injured in an automobile accident which occurred at Arcola, N. J., on July 1. The party was, at the time of the accident, motoring on a very dark road, and on making a turn the machine crashed into a telegraph pole. Mr. Atkinson was taken to the hospital at Hackensack where, it was reported, he was doing as well as could be expected.

B. W. COLLINS has recently been appointed city electrician of Tacoma, Wash., under the first administration of the new commission form of government, and has charge of all electrical work. The municipal plant furnishes all the lighting and most of the power in the city. Mr. Collins was formerly northwestern sales manager of the electrical department of Parrott & Company of San Francisco and previous to this was general superintendent of the Monterey County Gas and Electrical Company of Monterey, Cal.

OBITUARY.

W. A. STADELMAN, who was widely known in the electrical field, died on July 6 at his home in Rye, N. Y. Mr. Stadelman, though a comparatively young man, was one of the early workers in the field. He was a member of the firm of Chadbourne, Hazelton & Company, of Philadelphia, which was quite active in early electric railway and electric motor work. For several years Mr. Stadelman was identified with the Brown Hoisting Machinery Company, of Cleveland, and with the Wellman-Seaver-Morgan Company of the same city, residing for a time in Cleveland, and later in New York. For the past two or three years Mr. Stadelman was at the head of the Darley Engineering Company, of New York. His death was caused by diabetes, and will be deeply regretted by a very large circle of friends. He leaves a wife and two daughters, and was forty-six years of age. The funeral services were held in Rye, July 8, and the body was interred in Philadelphia, the former home of the deceased.

NEW INCORPORATIONS.

INDIANAPOLIS, IND.—The Auto Electric-Lite Company has filed articles of incorporation with the Secretary of State. The capital stock is $15,000.00. The object of the company is to manufacture and sell electric light generating machines and devices. The principal office and factory will be in Indianapolis. The directors are: George L. Fish, W. F. McCloud, O. M. Fish and E. V. McCloud. S.

INDIANAPOLIS, IND.—The American Electric Headlight Company, with chief offices in Indianapolis, has filed articles of incorporation with the Secretary of State. The object of the corporation is to manufacture and sell electric and other headlights for use on locomotives, engines, vehicles and other conveyances, and electric and other lamps for general use, the manufacture and construction of parts for the same, and the installation thereof. The capital stock is $50,000 and the directors are: Charles S. Stone, Charles N. Elliott and Harry B. Gates. S.

PROPOSALS.

CONDUIT SYSTEM.—Sealed proposals indorsed "Proposals for Underground Conduit' will be received at the bureau of yards and docks, Navy Department, Washington, D. C., until 11 o'clock a. m., July 23, 1910, for extensions to underground conduit system for electrical conductors at the navy yard, Boston, Mass. Plans and specifications can be obtained on application to the bureau or to the commandant of the navy yard named.

POST OFFICE, CHELSEA, MASS.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until August 4, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Chelsea, Mass., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Chelsea, Mass., or at the Supervising Architect's office.

LIGHT FIXTURES.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., Wednesday, July 20, 1910, for furnishing and installing lighting fixtures in the U. S. buildings at Boulder, Colo.; Clarida, Iowa; Fayetteville, Ark.; Kearney, Neb.; Logan, Utah; Marion, Ohio; Mayfield, Ky.; Pittsburg, Kan.; Shenandoah, Iowa, and Newark, N. J.; in accordance with the drawing and specifications, copies of which may be obtained at the office of the supervising architect. The right is reserved to reject any and all bids and to waive defects. Each proposal must be accompanied by a certified check in the sum of ten per cent of the aggregate amount thereof.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies.

Date.	Article.	Quantity.	Delivery at Navy Yard.	Schedule Number.
July 19—	Lamps, arc	200	Norfolk, Va.	2674
	Lenses and shades for running lights	Miscellaneous.	Brooklyn, N. Y.	2675
July 26—	Fans, desk and bracket.	Miscellaneous.	Various	2692
	Supplies, telephone.	Miscellaneous.	Various	2692
	Transmitters and indicators combined, etc.	2	Brooklyn, N. Y.	2693
August 2—	Wire, copper, weather-proof	Miscellaneous.	Puget Sound, Wash.	2687

INDUSTRIAL ITEMS.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., makes especial mention of the result of "Hotpoint Day" in the July issue of its publication, *Hot Points*. For the convenience of companies handling this iron, a list of selling points is also published in the issue.

THE FEDERAL ELECTRIC COMPANY, Chicago, Ill., prints in its monthly publication, *The Federalist*, descriptions and illustrations of its line of supplies. The July number contains some material on the installation of Federal adjustable floor boxes in the Gimble Store,, New York City.

THE CROUSE-HINDS COMPANY, Syracuse, N. Y., illustrates in Series 2, No. 2, of Conduiet Talk a number of condulets with vapor-proof globe and guard. These Type V. condulets are especially designed for use in rooms filled with steam or vapor or for places exposed to the weather.

THE STUDEBAKER COMPANY, New York City has received a letter from an enthusiastic purchaser of one of their cars, who states that since 1905 he has traveled 87,715 miles in a Studebaker Electric, which he believes to be a record for the given length of time. The car is a 1903 model and has been in operation continuously.

THE YOST ELECTRIC MANUFACTURING COMPANY, Toledo, Ohio, has secured a decision in the United States Circuit Court of Appeals in the suit which was brought against it for infringement of a patent covering lamp sockets. The Yost sockets can now be used without any risk of trouble. They will send a sample upon request.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has illustrated in its July number of the *Emerson Monthly*, a number of electric fans of various types. The announcement is made in this issue that the company has discontinued the manufacture of the double and single-cylinder electric air pumps described in bulletin No. 3803.

THE LORD MANUFACTURING, THE LORD ELECTRIC and THE LORD CONSTRUCTION COMPANIES are taking contracts for lighting installations, for parks, municipalities, factories and mills. In these contracts they are supplying their Luminata flaming-arc lamps, which are meeting with great success. In rolling mills and factories the light from these arcs is of such a character that it improves working conditions to a marked degree.

THE INVINCIBLE-ELECTRIC BANK PROTECTION COMPANY, Monroe, Wis., announces that in addition to manufacturing double-steel electrified vault linings and complete electrical alarm systems, it will also make steel safe-deposit boxes, filing cases, roller shelving, omnibuses, desks, tables, etc. Although the factory

capacity has been doubled during the past three months, the plant is now crowded to its utmost.

THE HOLOPHANE COMPANY, Newark, O., recently issued the June number of *Holophane Illumination* containing a number of illustrations of well designed lighting. In an article entitled "Light on the Object, Not on the Eye," the principle of correct window lighting is well shown by the use of two illustrations one of the wrong method of lighting and the other of the right method. Mention is also made of New York City's Trinity building, which is a model of Holophane installation.

THE F. W. WAKEFIELD BRASS COMPANY, Vermilion, O., announces that the Wakefield universal fixture bodies, both round and square, designed to carry either two, three or four arms, have been passed upon by the National Board of Fire Underwriters and put on the list of approved fittings. It was not necessary to make a single change in the construction of the bodies to meet the views of the National Board. The round square fixtures are shown in new catalog No. 9 of electric fixtures, which catalog also shows all the new additions.

THE BRISTOL COMPANY, Waterbury, Conn., has published an illustrated index of Bristol's recording instruments for pressure, temperature and electricity. A description of the Wm. H. Bristol electric pyrometers are also included. The company announces that this publication is not a catalogue, but simply a series of illustrations of the most important Bristol instruments with a partial explanation of the instruments and their applications. Bulletins cataloging the various instruments separately will be sent on application to the Bristol Company.

THE WALKER ELECTRIC COMPANY through its western branch in the Monadnock Block, Chicago, recently closed the switchboard equipment for the Chicago and Northwestern Railway Company's Chicago terminal powerhouse. The home office of this company, Philadelphia, reports the closing of the switchboard equipment for the Curtis Publishing Company's new powerhouse. The equipments both include very complete outfits of motor operated remote-control I-T-E circuit breakers. The aggregate cost of these two contracts exceeds one hundred thousand dollars.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has received an order from the National Starch Company, of Oswego, N. Y., for a 937-kilovolt-ampere, 480-volt, three-phase, sixty-cycle, steam-turbo alternator. Excitation for this will be supplied by a small generator coupled to an extension of the turbine shaft. A Type "C" Allis-Chalmers condenser will be used to maintain the vacuum. One of the interesting features of the installation is that the turbine will be so arranged that steam can be taken from it at a low pressure for use in the processes of manufacture.

THE MINE AND SMELTER SUPPLY COMPANY, which maintains large offices and warehouses at Denver, El Paso and Mexico City, with executive offices at 42 Broadway, New York City, announces that it has taken over the agency for the entire western territory of the United States of the line of pumps made by the Epping-Carpenter Company, Pittsburg, and the line of compressors made by the Burry Compressor Company, Erie, Pa. The Mine & Smelter Supply Company considers that it is now better prepared than ever before to take care of the trade in these two lines.

THE WESTERN ELECTRIC COMPANY has just issued bulletin No. 1008, describing telephone power plant equipments for non-multiple switchboards. The publication contains twenty-four pages and is illustrated with many diagrams and cuts and presents some features of Western Electric power apparatus designed especially for telephone plants. The subject matter covers only such apparatus as is required for non-multiple switchboards having capacity up to 800 lines and which have been described in three bulletins previously published. These are Nos. 1003 and 1004, non-multiple central office switchboards, and No. 1005 branch exchange switchboards.

THE SPRAGUE ELECTRIC COMPANY, New York, N. Y., describes at length in bulletin No. 600, its line of single and polyphase induction motors. The type R motors and the type S motors for polyphase circuits meet the demand for small and large motors of variable and constant speeds. The extensive use of alternating current for power and lighting circuits has made such a motor a necessity. The single phase type S and type R motors are made especially to meet the demand for small and moderate sized motors. In connection with the descriptions and illustrations of the motors and starting and controlling devices there are a number of curves, tables and winding diagrams. The company is also mailing booklets describing Sprague flexible steel armored hose and electric fans.

THE ACHESON OILDAG COMPANY, of Niagara Falls, N. Y., has purchased a factory site of thirty acres at Port Huron, Mich., and will erect there their prospective plant. Port Huron was selected as the site because of its comparatively pure water and excellent shipping facilities. Oildag has made phenomenal progress in the matter of establishing itself as a superlative lubricant and conserver of petroleum lubricating oils, but owing to the past limited manufacturing capacity of the company the price was of necessity high and retarded its rapid introduction into general lubrication. On the first of July, the Acheson Oildag Company reduced the selling price of Oildag to approximately sixty per cent of that previously quoted, thereby bringing it down to a price, when bought in quantity, of considerably less per gallon than that of the oil with which it is mixed. The presence of the deflocculated graphite in the oil makes each gallon equal to two to four gallons of plain oil.

THE CUTLER-HAMMER COMPANY, Milwaukee, Wis., has recently published a booklet entitled "Battery Charging Rheostats," The booklet describes this company's entire line of battery charging rheostats comprising two types for charging ignition batteries and six types for general charging work, for electric pleasure vehicles and for trucks. Full page illustrations of the various types are shown besides several special types such as a motor-generator set panel and a panel for use with a gas-engine driven dynamo and storage battery. One section of the booklet is devoted to descriptions and illustrations of protective panels and devices. The applications and advantages of the low-current cut-out, maximum-voltage cut-out, solenoid switch and overload circuit-breaker arrangements are pointed out. These devices prevent overcharging and protect the batteries against damage due to abnormal current conditions. The method of tabulating the electrical data and the list prices is worthy of comment, all information being condensed into a single table. This publication (copies of which can be had on request) should prove of value to all interested in battery charging.

DATES AHEAD.

National Electric Contractors' Association. Annual convention, Atlantic City, N. J., July 20, 21 and 22.

Ohio Electric Light Association. Annual convention, Cedar Point, Ohio, July 26, 27 and 28.

Michigan Electrical Association. Annual convention, Port Huron, Mich., August 16, 17 and 18.

League of American Municipalities. Annual convention, St. Paul, Minn., August 23-26.

Pacific Coast Electrical Exposition. San Francisco, Cal., August 20 to August 27, 1910.

International Association of Municipal Electricians. Annual convention, Rochester, N. Y., September 6, 7, 8 and 9.

Old Time Telegraphers' and Historical Association and the Society of the United States Military Telegraph Corps. Twenty-ninth annual reunion, Chicago, Ill., September 8-10.

Pennsylvania Electric Association Convention, Glen Summit Springs, Pa., September 14-16.

New England Section, National Electric Light Association, Fall convention, Pleasant Point, New London, Conn., September 13 and 14.

Colorado Electric Light, Power and Railway Association, Next convention, Glenwood Springs, Col., September 21, 22 and 23.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Kansas City, Kan., September 27-28.

American Street and Interurban Railway Association. Annual convention, Atlantic City, N. J., October 10-14.

American Society of Municipal Improvements. Annual convention, Erie, Pa., October 11-14.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) July 5, 1910.

963,036. HEADLIGHT OR ILLUMINATOR. Henry L. De Zeng, Philadelphia, Pa. Filed Oct. 18, 1909. The device comprises a body portion, an electric lamp carried thereby, a concentrator lens carried by the body portion, a reflecting device carried by the body portion, and mean carried by the body portion for universally mounting the body portion upon a suitable support.

963,035. ELECTRIC BOND. Thomas J. Cope, Philadelphia, Pa. Filed Oct. 23, 1909. A support for an electric bond is composed of an attaching plate, and a tongue and a keeper on the plate, the keeper being integral with the plate.

963,056. HANGER OR SUPPORT FOR TELEPHONE WIRES. Frank W. Morse, Boston, Mass. Filed July 28, 1908. The hanger comprises substantially parallel arms having bent fingers co-operating with the arms to form contracted throats, and substantially parallel loop portions extended from the arms and provided with free ends which co-operate with the arms to form entrance openings into the loops.

963,057. ILLUMINATED FLOWER-HOLDER. Frederick Muschenheim, New York, N. Y. Filed Sept. 15, 1909. The device comprises a reservoir, a light-transmitting pan supported thereby and extending laterally beyond the same, and electric

light bulbs projecting from the resorvoir beneath the pan.

963,062. SECRET TELEGRAPH SYSTEM. Walter Polk Phillips, Bridgeport, Conn. Filed Nov. 8, 1909. A system of telegraphy for the secret transmission of messages includes a station set comprising a Morse key, and receiving instruments in parallel, one of the receiving instruments being of the sounder type but having a dead or silent armature-stop, whereby signals received thereby will be enunciated in mutilated or fragmentary form, the other receiving instrument being of the telephonic type.

963,064. QUICK-BREAK KNIFE-SWITCH. Clarence D. Platt, Bridgeport, Conn. Filed Mar. 1, 1909. A pivoted main blade has a portion of one edge cut away to form a recess; an auxiliary blade pivoted to the main blade is offset to form a body portion adapted to fill the recess and a spring normally holds the auxiliary blade in the recess, the auxiliary blade being also provided with an extension to engage the under side of the main blade to limit the separation of the blades.

963,072. LUXIMETER. Walter D'A. Ryan, Watertown, S. D., assignor to General Electric Company. Filed Oct. 15, 1909. A light-transmitting device for photometers comprises a translucent block proportioned to render the light transmitted through the block porportional to the intensit yof light received by a plane surface in the position of the block.

963,091. STEERING-GEAR APPARATUS. August Sundh, Yonkers, N. Y. Filed Sept. 21. 1905. The apparatus includes a motor, sectional starting resistance therefor, electric switches for modifying the resistance, accelerating magnets having windings connected in series with each other, and automatic means operated by the motor for controlling the magnets.

963,096. SYSTEM OF ELECTRIC METERING. Matthew O. Troy, Schenectady, N. Y., assignor to General Electric Company. Filed June 3, 1905. A system of multirate metering includes electric translating devices, an electric meter, an actuating coil therein, conections for supplying the coil with current bearing a definite relation to current consumed, and means for supplying the coil with current bearing a different relation to current consumed.

963,123. ELECTRICAL-RESISTANCE ALLOY. John T. H. Dempster, Schenectady, N. Y., assignor to General Electric Company. Filed Feb. 1, 1910. An electrical resistance conductor comprises iron, nickel, chromium and manganese, the iron constituting more than fifty per cent of the alloy.

963,127. MOTOR-CONTROL SYSTEM. Henry B. Emerson, Schenectady, N. Y., assignor to General Electric Company. Filed Nov. 13, 1907. Means operative in a slow-speed position of the controller are provided for connecting a braking resistance in shunt to the motor armature if the voltage across the armature of the motor exceeds a certain value.

963,132. THREE-PHASE TRANSFORMER. John J. Frank, Schenectady, N. Y., assignor to General Electric Company. Filed Apr. 18, 1908. In combination of a device for three-phase circuits having its primary and secondary windings Y-connected, is a third delta-connected winding having a lesser number of turns than either of the other windings and in inductive relation to them.

963,138. POWER-TRANSMISSION MECHANISM. Maximillian K. Golden and William H. Kendall, Detroit, Mich., assignors to Crown Hat Manfg. Co., Detroit, Mich. Filed Sept. 8, 1909. Power transmission mechanism comprises an electric motor, an electric circuit therefor including a source of electric energy and a circuit opening and closing switch, a rotatable member to be driven disposed in axial alinement with the motor shaft, a rotary driving member connected to the motor shaft and movable into frictional engagement with the driven member, means for actuating the driving member to carry it into engagement with the driven member, this means being operatively associated with the switch to close the motor circuit in advance of the frictional engagement between the driving and driven members.

963,147. MAXIMUM-INDICATOR FOR MEASURING INSTRUMENTS. Caryl D. Haskins, Schenectady, N. Y., assignor to General Electric Company, Filed June 22, 1906. In combination with a measuring instrument having a movable element, are means for indicating the maximum movement of said element comprising a plurality of indicators slidable over one another with a retarded movement due to frictional engagement and arranged to be moved successively by the element throughout a predetermined range and thereafter movable independently of the element.

963,160. STARTING DEVICE FOR ELECTRIC MOTORS. Harry H. Lee and Arnold E. Button, Schenectady, N. Y., assignors to General Electric Company. Filed Oct. 27, 1908. A starter for a polyphase induction motor.

963,163. LIQUID RHEOSTAT. Frederick Mackintosh, Schenectady, N. Y., assignor to General Electric Company. Filed Dec. 18, 1908. A rheostat comprises a fluid container provided with electrodes, an auxiliary container having a fluid conducting connection therewith, and means for raising and lowering one of the containers with respect to the other and a no-voltage device for controlling the auxiliary container.

963,169. APPARATUS FOR STARTING ELECTRIC MOTORS. Sidney B. Paine, Newton, Mass., assignor to General Electric Company. Filed May 28th, 1909. A system of distribution includes a source of voltage, a plurality of conductors, a plurality of motors connected thereto, switches connected in series between the motors and the conductors, overload tripping devices for the switches, a compensator adapted in one position to connect the conductors to a portion of the voltage of the source and in a second position to the full voltage of the source, and means for rendering the tripping devices inoperative.

963,173. OSCILLATION-REVEIVER. Greenleaf Whittier Pickard, Amesbury, Mass. Original application filed Sept. 14, 1907. Divided and this application filed Mar. 16, 1910. An oscillation receiver comprises an electrical conductor in electrical contact with a substantially rough, unpolished fracture surface of the electrically conducting solid, the mineral red oxide of zinc.

963,192. COMBINED TELEPHONE AND CONTROL SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company. Filed Jan. 15, 1906. A combined telephone exchange and control system comprises a telephone line extending to the exchange, substation telephone apparatus and a receiving device each connected to the line independently of the other, a source of current at the exchange adapted to be operatively associated with the line, means at the exchange for varying the connections of the source to vary the electrical condition of the line to operate the receiving device, other telephone lines, link-circuits for connecting the telephone line to the other telephone lines to establish conversation circuits through the substation telephone apparatus.

963,205. TROLLEY-WIRE ICE-REMOVER. John W. Brown, Hubbard, and Charles E. Doyle, Youngstown, Ohio. Filed June 3, 1909. In combination an electrical railway car, are an overhead wire through which the electricity is conducted, and pneumatically actuated means for removing ice from the wire.

963,213. TELEGRAPH APPARATUS. Robert L. Dean, Kansas City Mo., asignor to Dean Rapid Telegraph Co. Filed Feb. 12, 1906. A receiving and recording instrument consists of mechanism for feeding paper step by step, and shifting mechanism carried by a stylus alternately engages the adjacent sides of the propelling mechanism so that the stylus will be carried back and forth upon the paper.

963,216. WOOD SEPARATOR FOR SECONDARY BATTERIES. Louis H. Flanders, Edgewood Park, Pa., assignor to The Electric Storage Battery Company, Philadelphia, Pa. Filed Oct. 21, 1908. A separator for storage-battery plates comprises a sheet of wood veneer, wood stiffening ribs, the grain of which extends across the grain of the sheet, and lead tacks for securing the stiffening ribs to the sheet.

963,233. LIGHTING-ARRESTER. Bertram H. Mann, Webster Groves, Mo. Filed Aug. 19, 1909. A lightning arrester comprises a carbon bar, a glass plate adjacent thereto, a metal plate adjacent to the glass plate, a sheet metal strip attached to the carbon bar along its length and adapted to be connected to ground, and a plurality of carbon blocks slightly spaced from the carbon bar so as to form spark gaps therewith.

963,238. ELECTRIC BUZZER. James F. McElroy, Albany, N. Y., assignor to Consolidated Car Heating Company. Filed Sept. 16, 1909. An electric buzzer comprises a magnet, a circular diaphragm arranged to be vibrated by magnet, a supporting clip engaging the diaphragm at one point in its circumference, and an external part overhanging the edge of the diaphragm and with range of the vibrations of the circumference thereof.

963,259. HANGER FOR ARC-LAMPS. John M. Sutor, Oak Park, Ill. Filed Feb. 18. 1908. Includes supplemental switches mounted on contact members, etc.

963,284. STORAGE-BATTERY SEPARATOR. Ervin M. Fitz, Columbus, Ohio. Filed Feb. 2, 1910. A storage battery separator comprises a perforated plate of insulating material, with oppositely tapered ribs applied to each of the vertical edges thereof, and diagonal ribs extending transversely to the edges across each face of the plate, the diagonal ribs on the opposite sides of said plate extending transversely to each other so as to fully brace the plate.

963,288. TROLLEY-WIRE SPLICER. Howard L. Griswold and Thomas Kerin, Oakland, Cal. Filed June 26, 1909. A trolley-wire splicing device comprises a plate having beveled ends, spaced-apart parallel members carried by the plate and forming between them a wire-receiving groove, the members projecting beyond the ends of the plate, and a clamping lever pivotally mounted in each end of the groove and adapted to clamp a wire to the beveled ends of the plate.

963,298. TELEGRAPHIC RELAY. Isidor Kitsee, Philadelphia, Pa. Filed July 8, 1909. One of the contacts is operatively related

to the movable part of the relay and terminates in a graphic point; the second of the contacts presents to the first contact a disk-like surface consisting of graphite.

963,315. COMBINED SWITCH-BOX AND SUPPORT. John J. Odenwald, Washington, D. C., assignor of one-half to Julius Lansburgh and Irvin H. Hollander, Washington, D. C. Filed Feb. 19, 1910. A switch box comprises a body portion having its inner face provided throughout with a left thread, a cap comprising a body portion and a top, the body portion of the cap formed throughout with exterior left threads adapted to engage the threads of the body portion of the switch box whereby the cap and body portion will be coupled together, the body portion of the cap of less diameter than the top of the cap whereby the cap will be formed with an outwardly-extending flange for engagement with a support for coupling the switch box in position.

963,334. SPARKING DEVICE. Charles H. Stonebridge, New York, N. Y. Filed Jan 18, 1910. A spark plug for explosion engines.

963,339. ELECTRICAL SYSTEM OF DISTRIBUTION. William A. Turbayne, Lancaster, N. Y., assignor to Gould Storage Battery Company. Filed Aug. 25, 1906. Renewed Apr. 9, 1909. A battery-generator set.

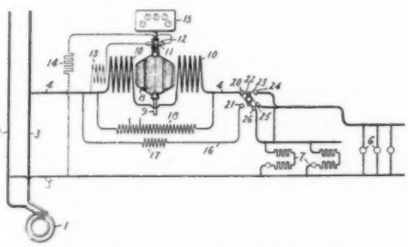
963,356. RAIL-BOND. Charles L. Cadle, Cleveland, Ohio, assignor to The Electric Railway Improvement Company, Cleveland, Ohio. Filed Mar. 1, 1906. A rail-bond is composed of a continuous flat metal strand wound upon itself a plurality of times to form a laminated strip, the strip being bent to provide laterally extending feet and an arched intermediate portion, such parts of the several turns of the strand as enter into the feet being compressed closely together, and there being a space left between such parts as enter into the arched intermediate portion.

963,476. CIRCUIT-BREAKING MECHANISM. William M. Scott, Philadelphia, Pa., assignor to The Cutter Electrical and Manufacturing Company. Filed Mar. 1, 1905. There are a plurality of electric switches each comprising main and shunt contacts arranged in substantial vertical alinement, and the main and shunt contacts of all switches arranged in substantial vertical alinement, the shunt contacts of an upper switch adapted to open before the shunt contacts of a lower switch.

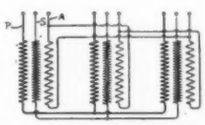
963,480. SWITCHBOARD FOR ELECTRICAL CONDUCTORS. John F. Skirrow, East Orange, N. J. Filed Jan. 4, 1910. Includes a row of insulated conducting buttons, a conducting strap, parallel with the row, arc-shaped complementary notches in the buttons and the strap, conducting pins in the notches and means for retaining the pins in conducting contact consisting of projecting sections of spring-metal electrically connected to the buttons and strap, respectively.

963,496. LIGHTNING-CONDUCTOR POINT AND POINT-ROD PROTECTOR. Carl Bajohr, St. Louis, Mo. Filed Nov. 16, 1909. The device comprises a tubular shield made of carbonaceous material, a closure plug fitted upon one end of the shield, and a lightning point extending into the tubular shield and engaging the closure plug.

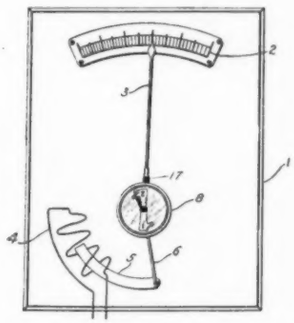
963,508. BRUSH-HOLDER. Maglorire Brodeur, Lynn, Mass. Filed Sept. 16, 1909. A holder for an electrical contact brush has a channel in which the brush is contained and through which it may be fed, a follower arranged to bear on the brush and to enter the brush channel, and guiding means for that end of the follower which projects from the channel, the guiding means being offset to permit displacement of the follower to one side of the channel.



963,096.—SYSTEM OF ELECTRIC METERING.



963,132.—THREE-PHASE TRANSFORMER.



963,147.—MAXIMUM INDICATOR FOR MEASURING INSTRUMENTS.

963,374. RELAY. Isidor Kitsee, Philadelphia, Pa. Filed Feb. 8, 1909. Comprises a field yoke or ring, a plurality of poles extending inwardly therefrom, a moving coil for each pair of poles, the coils being disposed at an agle with respect to each other and secured together and having their axes coincident.

963,395. RESISTANCE-BOX. Lewis T. Robinson, Schenectady, N. Y., assignor to General Electric Company. Filed Aug. 14, 1909. A resistance box comprises a base, an integral tubular member of insulation mounted on the base, contacts interlocked with the member and unyieldingly embedded in the inner walls of the members to form a socket for receiving a conducting bridging plug, and a resistance coil connected to one of the contacts.

963,412. MAGNETO-GENERATOR. Charles W. Wilson, Edgewood, Ill. Filed July 26, 1909. There is a U-shaped field-magnet formed of a single piece of material and having resilient limbs; pole-pieces are applied to the limbs of the field-magnet; an armature is mounted between the pole-pieces; and adjustable members are provided between the pole-pieces upon opposite sides of the armature for spreading the pole-pieces apart or permitting them to come together to regulate the air gap.

963,432. AUTOMATIC FIRE-ALARM SYSTEM. Albert Goldstein, New York, N. Y., and Horace E. Rice, Philadelphia, Pa., assignors to Automatic Fire Protection Company. Filed May 23, 1903. There are two independent alarm circuits and a battery in each, the circuits extending to the protected locality, a branch from one of the circuits leading to ground and a branch from the other circuit also leading to ground and an alarm transmitter in each branch.

963,437. ABRADING APPARATUS. Gustav A. Hassell, McKeesport, Pa., assignor to Pittsburg Steel Foundry, Pittsburg, Pa. Filed Dec. 31, 1909. The driving motor is directly connected through a universal coupling.

963,471. CONDUIT. Edia R. Ramsey, Penn Yan, N. Y. Filed Oct. 29, 1908. A conduit comprises two strips of material wound one upon the other and a thread passed twice through one of the strips and partially through the other thereof and locking them together.

963, 535. KEY-TURNER FOR ELECTRIC LIGHTS. Burt English, Fort Des Moines, Iowa. Filed Feb. 6, 1909. A spring-actuated lever device.

963,564. SPARKING PLUG FOR INTERNAL-COMBUSTION ENGINES. William H. Horner, Williams Bridge, N. Y. Filed Nov. 30, 1909. The device comprises a tubular plug, one end of which is closed and the other open and provided with a contact device, a magnet at one side of the plug and the core of which passes thereinto, the magnet and core insulated from the tube, a U-shaped spring placed in the tube and insulated therefrom, one arm of the spring being secured to the core of the magnet and the other arm being provided with a contact device.

963,567. ELEVATOR. Henry A. Humphrey, Kansas City, Mo., assignor to Safety Elevator Lock and Signal Company. Filed Dec. 21, 1908. An electric elevator.

963,568. ELEVATOR. Henry A. Humphrey, Kansas City, Mo., assignor to Safety Elevator Lock and Signal Company. Filed Dec. 26, 1908. Similar to preceding.

963,569. ELEVATOR. Henry A. Humphrey, Kansas City, Mo., assignor to Safety Elevator Lock and Signal Company. Filed Jan. 19, 1909. Similar to 963,567.

963,570. ELEVATOR. Henry A. Humphrey, Kansas City, Mo., assignor to Safety Elevator Lock and Signal Company. Filed June 24, 1909. Similar to 963,567.

963,571. TROLLEY. William W. Hutchingson, Brooklyn, N. Y. Filed Aug. 1, 1908. Includes a socketed block, a yoke for the wheel, a stem at the lower end of the yoke and having a groove partly surrounding it, a pin in the block and entering the groove, a spring at the bottom of the socket and attached to same and the stud, and a flange on the stem at the mouth of the socket.

963,612. ACCESSORY FOR INTERNAL-COMBUSTION ENGINES. Eugene D. Means, Towanda, Pa. Filed Feb. 16, 1910. There are two metallic plates, each having an arm, insulating means separating the plates (one of the plates being adapted for attachment to a spark plug), a binding post on

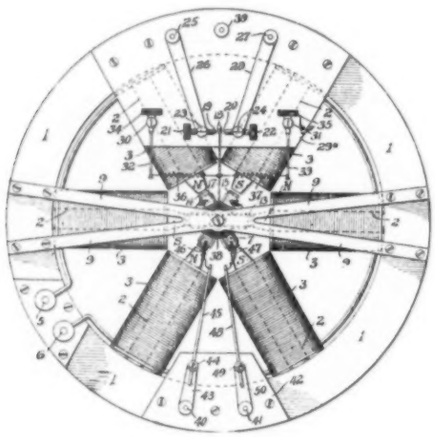
the other plate, and a switch lever pivotally attached to the arm of one of the plates and adapted to electrically and mechanically engage the arm of the other plate.

963,639. OUTLET-FIXTURE FOR CONDUITS. Henry T. Paiste, Philadelphia, Pa. Original application filed Mar. 18, 1908. Divided and this application filed Nov. 10, 1908. The fixture consists of a hollow structure provided with an opening for a conductor and having also an opening for the reception of a lamp socket, lugs on the structure projecting inwardly from the sides of the latter opening, a protective casing mounted over the opening, and a lamp socket confined between the casing and the lugs.

963,647. ELECTRIC-LAMP-SOCKET SUPPORT. Herbert E. Plass, Newark, N. J., assignor to Howard Miniature Lamp Company, Inc., Newark, N. J. Filed Jan. 13, 1910. The socket support comprises a bracket and means secured thereto to support a lamp socket with an interposed spring with its lower end secured to a part on the bracket and at its upper end to a part on the socket, the spring constituting the mechanical support for the latter

963,666. SLACK-SPOOL FOR ELECTRIC WIRING. Henry Van Altena, New Brunswick, N. J. Filed Sept. 14, 1909. In combination with a spool having a longitudinal passage, is a wire coil passing through the passage and having insulated hooks at its ends, and radial pins extend into the passage to engage the coil and hold the wiring.

963,671. ELECTRIC-LIGHT HANGER. Joseph P. Watson, Hazlehurst, Miss. Filed Sept. 22, 1909. A lamp hanger comprises a relatively fixed member having attaching means at its upper



963,374.—RELAY.

end and provided with a series of superposed outwardly and upwardly projecting supporting hooks, and a relatively adjustable member having a suspending hook at its upper end to engage any of the supporting hooks and provided at its lower end with a lamp-receiving socket and a manipulating handle, the adjustable member being further provided with an intermediately arranged lamp-cord guide.

963,673. HANGER FOR ELECTRIC LIGHTS. Edmund Herbert Weber, Chrisholm, Minn. Filed Nov. 6, 1909. The hanger comprises an approximately inverted-U-shaped stirrup, a supporting screw, an insulating body arranged between the screw and stirrup, and a spring upon which the stirrup rests.

963,678. ARRANGEMENT FOR STARTING AND REGULATING THE SPEED OF ALTERNATING-CURRENT MOTORS. Engelbert Arnold, Karlsruhe, Germany, and Jens Lassen la Cour, Edinburgh, Scotland. Filed May 15, 1905. Includes a rotor winding provided with a commutator, brushes bearing on the commutator, certain of the brushes connected to a source of current and forming the exciting circuit, at least two of the brushes short-circuiting the rotor winding, to produce a magnetization at an angle to that of the exciting circuit, and forming the compensating circuit, a main stator winding arranged to produce a magnetization along the line of magnetization of the compensating circuit, and an auxiliary stator winding arranged to produce a magnetization along the line of magnetization of the exciting circuit.

963,711. ELECTRIC SPARKING DEVICE. Joseph Arthur Jeffery and Benjamin Alfred Jeffery, Newark, N. J., assignors to Jeffery-De Witt Company, Newark, N. J. Original application filed Aug. 15, 1906. Divided and this application filed Feb. 4, 1908. A spark plug comprises an electrode having a sparking point, an insulating casing therefor completely inclosing the electrode and provided with a spark duct of less diameter than the sparking point and leading outwardly therefrom and a second electrode arranged exteriorly of the casing and arranged in line with the duct.

963,728. ELECTRIC SIGNAL-SWITCH. James I. Ayer, Cambridge, Mass., asignor to Simplex Electric Heating Company, Boston, Mass. Filed Dec. 27, 1909. In combination with a translating device and its supply circuit, is a visual signal for indicating when current is being supplied to the translating device, and an automatic cut-out operates automatically to cut off the current supply from the translating device whenever the signal fails.

963,733. PLUG-SWITCH. John H. Kliegl, New York, N. Y. Filed July 22, 1907. A binding plate enables the plug to be withdrawn from its receptacle by pulling on the cable without transmitting the stress to the connections of the conductors and contacts.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired July 11, 1910.

501,059. REGULATOR FOR DYNAMO-ELECTRIC MACHINES. William H. Elkins, Cambridge, Mass.

501,060. BRUSH FOR DYNAMO-ELECTRIC MACHINES AND MOTORS. Jonathan P. B. Fiske, Lynn, Mass.

501,068. ELECTRIC SNAP-SWITCH. Caryl D. Haskins, Lynn, Mass.

501,071. ELECTRIC SWITCH. Carl F. W. Hofer, Berlin, Germany.

501,074. ELECTRIC ARC LAMP. Josef Jergle, Vienna, Austria-Hungary.

501,080 and 501,081. ELECTRIC ARC-LAMP. Georg Kirkegaard, Brooklyn, N. Y.

501,085. TELEPHONE CIRCUIT AND APPARATUS. Sherwood J. Larned, Evanston, Ill., and Frank A. Pickernell, Newark, N. J.

501,086. STATION APPARATUS FOR TELEPHONE CIRCUITS. Sherwood J. Larned, Evanston, Ill., and Frank A. Pickernell, Newark, N. J.

501,087. ELECTRIC SIGNALING. Thomas D. Lockwood, Melrose, Mass., and Sherwood J. Larned, Evanston, Ill.

501,095. ELECTRIC-LIGHTING SYSTEM. Paul Nordmann, Berlin, Germany.

501,100. RAILWAY SIGNALING APPARATUS. Robert Pfeil, Berlin, Germany.

501,102. TELEPHONE SIGNALING APPARATUS AND CIRCUIT. Frank A. Pickernell, Newark, N. J.

501,114. LIGHTNING ARRESTER. Elihu Thomson, Lynn, Mass.

501,117. DYNAMO-ELECTRIC MACHINE. Harry L. Tyler, Corning, N. Y.

501,151. ELECTRIC BATTERY. James H. Mason, Brooklyn, N. Y.

501,168. TELEPHONE SWITCH. Charles E. Scribner, Chicago, Ill.

501,169. TELEPHONE-EXCHANGE APPARATUS. Charles E. Scribner, Chicago, Ill.

501,170. DUPLEX ELECTRIC-ARC LAMP. Charles E. Scribner, Chicago, Ill.

501,172. MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS. Elihu Thomson, Swampscott, Mass.

501,173. ELECTRIC SWITCH. Frederick A. Thum, Newark, N. Y.

501,183. ELECTRIC SIGNALING CIRCUIT. William Daves, Jersey City, N. J.

501,191. SWITCH FOR ELECTRIC CONDUCTORS. Olof Offrell, Middletown, Conn.

501,194. REVOLVING ARMATURE FOR ELECTRIC MACHINES. Elmer A. Sperry, Chicago, Ill.

501,195. ELECTRIC LOCOMOTIVE. Elmer A. Sperry, Chicago, Ill.

501,201. AUTOMATIC CIRCUIT-INTERRUPTER. Alexander Wurtz, Pittsburg, Pa.

501,205. SOCKET FOR INCANDESCENT LAMPS. Axel Ekstrom, Lynn, Mass.

501,206. ELECTRIC CONDUIT APPARATUS. Jonathan P. B. Fiske, Lynn, Mass.

501,246. ELECTRIC LOCOMOTIVE. William E. C. Eustis, Milton, Mass.

501,258. ELECTRIC CIRCUIT-CLOSING DEVICE. William Sears, Boston, Mass.

501,291. ELECTRIC TIME-SWITCH. James F. McLaughlin, Philadelphia, Pa.

501,292. ELECTRIC BELL. Wilson J. Newman, Brooklyn, N. Y.

501,294. FENDER FOR ELECTRIC CABLE OR OTHER SIMILAR CARS. William J. Nunn, Hyde Park, Mass.

501,306. ELECTRIC ALARM MONEY-DRAWER. William J. Walker and Alexander L. Bedford, St. Louis, Mo.

501,307. RAILWAY-SIGNAL. James Wayland, Newark, N. J.

501,309. METHOD OF REGULATING DYNAMO-ELECTRIC MACHINES. Merle J. Wightman and Hermann Lemp, Hartford, Conn.

501,376. ARMATURE. Joseph J. Smith and George W. Findlater, Jamaica, N. Y.

501,438. RAILROAD-CROSSING ALARM OR SIGNAL. Elwood C. Potter, Vineland, N. J.

501,450. ELECTRIC SWITCH. Lucius T. Stanley, Brooklyn, N. Y.

501,472. STATION APPARATUS FOR TELEPHONIC AND TELEGRAPHIC CIRCUITS. Theodore Spencer, Cambridge, Mass.

501,482. REVOLVING MOTOR. Herbert L. Parker and Alexander W. Meston, St. Louis, Mo.